United States Department of Agriculture

Soil Conservation Service

In cooperation with University of Nebraska, Conservation and Survey Division

Soil Survey of Blaine County, Nebraska

How To Use This Soil Survey

General Soil Map

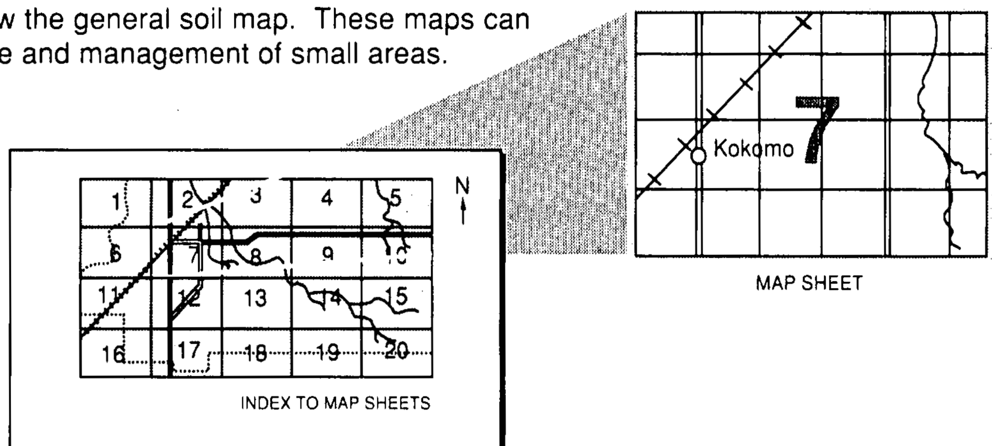
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

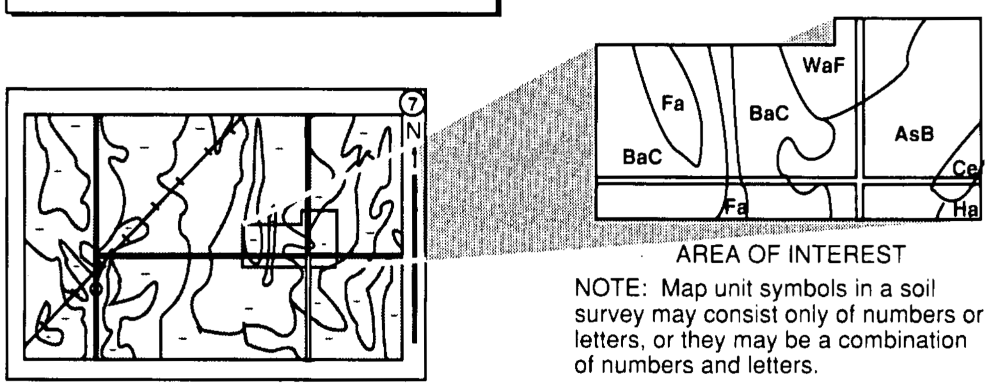
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska, Conservation and Survey Division. It is part of the technical assistance furnished to the Upper Loup Natural Resources District. The Upper Loup Natural Resources District and the Blaine County Commissioners provided financial assistance to employ a soil scientist to accelerate completion of the soil survey.

Cover: A typical landscape in the Valentine-Ipage association. This association is best suited to range. The Valentine soils are on the dunes, and the Ipage soils are in the valleys.

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Issued September 1993

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Foreword

This soil survey contains information that can be used in land-planning programs in Blaine County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Ronald E. Moreland

Ronald E. Moreland
State Conservationist
Soil Conservation Service

Soil Survey of Blaine County, Nebraska

By Daniel R. Shurtliff and Vernon C. Seevers, Soil Conservation Service, and
Francis V. Belohlavy, Bruce C. Evans, and Mark S. Kuzila, University of Nebraska,
Conservation and Survey Division

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the University of Nebraska, Conservation and Survey Division

BLAINE COUNTY is in the north-central part of Nebraska (fig. 1). It has a total area of 458,131 acres. It is bordered on the south by Custer and Logan Counties, on the west by Thomas County, on the north by Cherry and Brown Counties, and on the east by Loup County. Dunning is the largest town in the county. Brewster is the county seat.

The economy of the county is based primarily on ranching. About 95 percent of the county is covered with native grass and is used as range or hayland. Ranchers produce feeder cattle and purebred breeding stock. Less than 5 percent of the county is used as cropland. Alfalfa is the principal dryland crop. Corn and alfalfa are the main irrigated crops. Although most of the corn is sold as a cash crop, some is used as livestock feed. Alfalfa hay is used as winter livestock feed.

In normal years, the lack of seasonal rainfall limits crop production under dryland management. Gravity irrigation systems are used on some of the loamy soils on the stream terraces along the North Loup River. Sprinkler systems are used mostly on the undulating, sandy soils. Throughout the county, wells supply sufficient water for domestic uses and for livestock and irrigation. Depth to the water table varies according to relief and the thickness of the sandy and loamy material overlying water-bearing gravel.

Blaine County is in the southeastern part of the Nebraska Sandhills. The hilly topography of the sandhills is broken by small, nearly level or undulating swales. The topography is further modified by the valleys along the North Loup, Middle Loup, and Dismal Rivers, which flow southeasterly across the county. The soils on the bottom land and stream terraces formed in sandy or loamy alluvium. Scattered areas of loamy material are throughout the sandhills in the southeastern part of the county. In some areas the loess is completely covered with sand. Soils in these areas range from sandy to loamy.

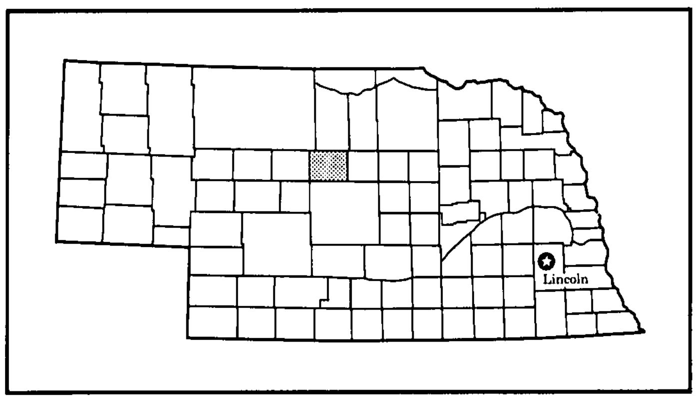

Figure 1.—Location of Blaine County in Nebraska.

The county is nearly level or gently sloping in the river valleys and nearly level to very steep in the sandhills. The upland soils in the sandhills are excessively drained. The soils in the valleys are excessively drained to very poorly drained.

A railroad crosses the southwestern part of the

county. State Highway 2 runs parallel to the railroad through Dunning. State Highway 91 provides the main east-west route through the county and connects Dunning and Brewster. State Highway 7 extends north of Brewster to Ainsworth in Brown County. County roads in the sandhills generally do not follow section lines. Trails provide access where needed if state highways or county roads are not available.

The county has no rural schools. Students attend elementary school at Brewster or at Halsey, in Thomas County, and high school at Dunning.

Much of the livestock and grain produced in the county is transported to markets outside the county. Agribusinesses are located in Brewster, Dunning, Purdum, and surrounding communities.

This soil survey updates the survey of Blaine County published in 1954 *(3)*. It gives additional information and has larger scale maps, which show the soils in greater detail.

General Nature of the County

This section provides general information about Blaine County. It describes history and development; climate; geology and ground water; physiography, relief, and drainage; and trends in ranching, farming, and land use.

History and Development

The river valleys in Blaine County were hunting grounds for the nomadic plains Indians before settlers came to the region. Big game was abundant when the first settlers arrived. Samuel N. Dunning and the Van Syckle family were among the first permanent settlers in the county. They settled near the present site of Dunning. By the mid-1870's, several large cattle ranches were in the survey area. During the 1880's and early 1900's, settlers acquired land through the Homestead and Kincaid Acts and moved into the region. Dryland farming was attempted, but drought, insects, and a severe hazard of soil blowing on the sandy land discouraged the farmers, who then sold their land to the cattle ranchers.

Blaine County was organized in 1886. It was named for James G. Blaine, a politician from Maine. Brewster, the first town in Blaine County, was established in 1885. Dunning and Purdum were established in 1886. Ladora was the original county seat. In 1889, the county seat was changed to Brewster and most of the businesses in Ladora moved to Brewster. Of the early towns, only Dunning, Brewster, and Purdum remain *(4)*.

The population of Blaine County has fluctuated through the years. It peaked in 1920, when it was 1,778. In 1980, it was 867. Dunning is the largest town in Blaine County and has a population of 186. Brewster has a population of 46.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

The climate in Blaine County is characterized by cold winters and long, hot summers. Heavy rains occur mainly in spring and early summer when moist air from the Gulf of Mexico interacts with the drier continental air. Snowfall is fairly frequent in winter, but snow cover is usually not continuous. Annual precipitation normally is adequate for wheat, sorghum, and range grasses.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Purdum in the period 1951 to 1984. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 25 degrees F and the average daily minimum temperature is 12 degrees. The lowest temperature on record, which occurred at Purdum on December 22, 1983, is -36 degrees. In summer, the average temperature is 72 degrees and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred at Purdum on July 11, 1954, is 109 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 21 inches. Of this, nearly 17 inches, or about 77 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 8 inches. The heaviest 1-day rainfall during the period of record was 4.87 inches at Purdum on May 7, 1977. Thunderstorms occur on about 45 days each year. Tornadoes and severe thunderstorms, some with hail, occur occasionally. These storms are local and of short duration, and the pattern of damage is variable and spotty.

The average seasonal snowfall is about 30 inches. The greatest snow depth at any one time during the period of record was 16 inches. On the average, 20 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in spring.

Geology and Ground Water

Pierre Shale underlies Blaine County at a depth of about 700 to 1,000 feet. It consists of black and bluish gray shale of the Late Cretaceous period. This rock unit is so fine textured that it would yield virtually no water if wells were drilled into it. Some older units, however, would produce water.

Overlying the Pierre Shale are units deposited in the Tertiary period. These units include the Chadron Formation and the overlying, younger Brule Formation. These formations are of Oligocene age. They are not considered to be potential aquifers. The Ogallala Formation overlies the Brule Formation. It is composed principally of sand, sandy silt, and lime-cemented sandstone. It is of Miocene age and, in several places along the North Loup River, is the oldest unit that crops out.

Unconsolidated fluvial and eolian deposits of Quaternary age overlie the Ogallala Formation. The fluvial deposits consist of gravel, sand, silt, and clay, which are overlain by sand dunes that range from 10 to more than 150 feet in height. These dunes support a cover of grass. The fluvial deposits and the underlying deposits of the Ogallala Formation are aquifers that can yield water for domestic use and for irrigation. The water table in valleys is at a depth of less than 20 feet.

Blaine County has 104 registered irrigation wells. Most of these wells yield about 400 to 2,000 gallons of water per minute. The ground water throughout the county is of good quality for irrigation. The supply is adequate for all purposes.

Ground water contributes to the principal streams flowing through the county. It can be contaminated by drainage from feedlots, septic tank absorption fields, and other waste disposal systems. Shallow wells are more likely to become contaminated than deep wells.

Physiography, Relief, and Drainage

Blaine County is in the Great Plains physiographic province. Most of the county is in the Nebraska Sandhills. The extreme southeast corner of the county is in a loess-sand transition area. The surface features are the result of wind and water action.

The sandhills topography consists of a succession of stabilized sand dunes. The dunes range from about 10 to 150 feet in height. They are generally long and narrow and are oriented in northwest to southeast direction. Nearly level and gently sloping valleys are interspersed throughout the dunes. A seasonal high water table causes subirrigation in some low areas. Wet meadows, marshes, and shallow lakes are sometimes formed. The surface drainage pattern is well defined only in areas along the Middle Loup, North Loup, and Dismal Rivers.

The loess-sand transition area consists of nearly level to steep, silty and loamy uplands and scattered areas of sandhills. Low ridges, which were formed by wind action, are common in the loamy areas. The surface drainage pattern is well defined in most areas. A few areas have poorly defined drainageways, and runoff is sometimes ponded in valleys or shallow depressions.

The valleys consist of alluvium deposits on bottom land and stream terraces along the larger streams. They range from about ¼ mile to 2 miles wide and occur along the North Loup and Middle Loup Rivers. The nearly level bottom land is modified in places by shallow stream channels. The ground water provides subirrigation. The lowest positions on the bottom land are subject to flooding. Broad stream terraces are along the North Loup River. They are 10 to 30 feet above the stream channel and are not subject to flooding. The stream terraces consist mostly of nearly level sandy alluvium. In some areas the sand has been reworked into low hummocks by the wind. The seasonal high water table on the stream terraces is normally at a depth of more than 3 feet. In most areas, the surface drainage is slow and drainageways are not well defined.

Blaine County is drained by the Middle Loup, North Loup, and Dismal Rivers and their tributaries. The major streams flow toward the southeast. Wild Horse Creek flows into the Dismal River from the south. The Dismal River flows into the Middle Loup River from the west. Rifle Creek flows into the Middle Loup River from the south. Goose Creek flows into the North Loup River from the north. The North Loup, Middle Loup, and Dismal Rivers and Goose Creek are permanent flowing streams. The other creeks are dry most of the time.

The highest elevation in the county is about 2,940 feet. It is in the sandhills south of Purdum, near the Thomas-Blaine County line. The lowest elevation is about 2,395 feet. It is on the bottom land along the North Loup River, at the Blaine-Loup County line. The elevation is 2,495 feet at Brewster, 2,624 feet at Dunning, and 2,700 feet at Purdum. The general slope of the county is to the southeast.

Trends in Ranching, Farming, and Land Use

Ranching has been the major economic enterprise in Blaine County since the area was settled. The number of farms and ranches in the county slightly decreased from 135 in 1964 to 125 in 1984. Ranches in the sandhills are generally cow-calf operations that sell feeder calves and yearlings. A few combinations of livestock and cash-grain enterprises are in the valleys of the North Loup and Middle Loup Rivers. From 1964 to 1984, the number of cattle remained fairly constant and showed a slight increase. The acreage of cropland, however, has dramatically increased since 1964.

The number of livestock tends to fluctuate on a yearly basis, depending on the economy and the weather. The number of beef cattle has been fairly constant. The total number of cattle was 39,960 in 1964 and 38,000 in 1984. The number of dairy cows decreased from 510 in 1964 to 150 in 1984. The number of hogs has risen sharply, from 780 in 1964 to 8,500 in 1984. The number of sheep has been constant. The total number reported in 1984 was 220. A few poultry farms are in operation in the valley of the Middle Loup River, near Dunning.

The acreage used for crop production has increased considerably from 1964 to 1984. Grain crops were planted on 500 acres in 1964 and on 6,600 acres in 1984. This increase is due mostly to the development of sprinkler irrigation systems. Irrigated land in the county has increased from 1,000 acres in 1964 to 14,000 acres in 1984. Most of this increase has been since 1970. The number of registered irrigation wells rose from 10 in 1964 to 104 in 1984. Most of the irrigation water used in Blaine County is from deep wells. In a few areas, the water is pumped from nearby rivers.

In 1982, grain crops were grown on 6,600 acres in Blaine County. Of this total, irrigated corn was grown on 6,000 acres. Sorghum, oats, wheat, and rye were grown on the rest. The number of acres used for alfalfa hay fluctuates yearly but averages about 8,500 acres. About two-thirds of the acreage used for alfalfa was irrigated in 1984.

Native grass harvested for hay has decreased steadily from 1964 to 1984. About 114,250 acres was harvested in 1964 and 25,100 acres in 1982. The average yield, however, increased from 0.45 ton per acre to 1.0 ton per acre.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for

laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are named and mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some soil boundaries and names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinements in series concepts, different slope groupings, and the application of the latest soil classification system.

Soil Descriptions

1. Valentine Association

Deep, rolling and hilly, excessively drained, sandy soils; on uplands

This association consists of soils on dunes in the sandhills (fig. 2). Many of the dunes rise as much as 100 feet or more above the valleys. The soils formed in sandy eolian material. Slopes range from 9 to 60 percent.

The association includes about 262,440 acres, or 57 percent of the county. It is about 97 percent Valentine soils and 3 percent minor soils.

Valentine soils are rolling and hilly and are excessively drained. Typically, the surface layer is grayish brown, loose fine sand about 5 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is pale brown and very pale brown fine sand.

Of minor extent in this association are Els, Gates, Ipage, and Tryon soils. The somewhat poorly drained Els and moderately well drained Ipage soils are in swales. The well drained Gates soils are on uplands. Tryon soils are in the lowest landscape positions. They have a seasonal high water table that is near or above the surface for short periods. Also of minor extent is Blownout land, which is common throughout the association.

The Valentine soils support native grasses and are used as range. They are unsuited to cultivated crops because of the sandiness and the slope. The landscape is hilly, and access to all areas is difficult. Ranching is the main enterprise. Most ranches produce feeder calves and yearlings. Suitable wells for livestock and domestic water can be readily drilled.

Soil blowing is a serious hazard on the Valentine soils. If the protective grass cover is destroyed, blowouts can form. The range consists mainly of tall and mid prairie grasses. Management that includes proper grazing use and a planned grazing system helps to maintain or improve the range condition.

2. Valentine-Ipage Association

Deep, nearly level to hilly, excessively drained and moderately well drained, sandy soils; on uplands and in sandhill valleys

This association consists of soils on hummocks and dunes in the sandhills and in the intervening dry valleys. The sandhill dunes are generally oriented in a northwest to southeast direction. Slopes range from 0 to 60 percent.

The association includes about 89,790 acres, or 20 percent of the county. It is about 89 percent Valentine soils, 7 percent Ipage soils, and 4 percent minor soils (fig. 3).

Valentine soils are gently sloping to hilly. They formed in sandy eolian material. They are on dunes and are excessively drained. Typically, the surface layer is

Figure 2.—Typical landscape in the Valentine association.

grayish brown, loose fine sand about 5 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is pale brown in the upper part and very pale brown in the lower part.

Ipage soils are nearly level and very gently sloping. They formed in sandy eolian and alluvial material. They are in sandhill valleys between areas of the Valentine soils and are moderately well drained. Depth to the seasonal high water table ranges from about 3 feet in wet years to about 6 feet in dry years. Typically, the surface layer is grayish brown, very friable fine sand or loamy fine sand about 6 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 9 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. Mottles are below a depth of 34 inches.

Of minor extent in this association are Dunn, Els, Gates, Hersh, and Tryon soils. The moderately well drained Dunn soils are on uplands. They have loamy underlying material. The somewhat poorly drained Els soils and the poorly drained Tryon soils are lower on the landscape than the Ipage soils. The well drained Gates and Hersh soils are on uplands. They are loamy. Also of minor extent are small areas of Blownout land, which are common on the Valentine soils throughout this association.

The major soils in this association mainly support native grasses and are used as range. A few areas are used as hayland. Ranching is the main enterprise. Most ranches produce feeder calves and yearlings. These soils generally are unsuited to cultivated crops because of the sandiness and the slope of the Valentine soils. A few areas of dunes that have gentler slopes are poorly suited to sprinkler irrigation. Wells produce good-quality water for livestock and domestic uses.

Soil blowing is the main hazard on these soils. If the protective grass cover is destroyed, blowouts can form. The range consists mainly of tall and mid native prairie grasses. Management that includes proper grazing use and a planned grazing system helps to maintain or improve the range condition.

3. Valentine-Els-Ipage Association

Deep, nearly level to rolling, excessively drained, somewhat poorly drained, and moderately well drained, sandy soils; on uplands and in sandhill valleys

This association consists of soils on hummocks and dunes in the sandhills and in the intervening wet valleys. The sandhill dunes are generally oriented in a northwest to southeast direction. Slopes range from 0 to 24 percent.

The association includes about 56,060 acres, or 12 percent of the county. It is about 33 percent Valentine soils, 28 percent Els soils, 25 percent Ipage soils, and 14 percent minor soils (fig. 4).

Valentine soils are gently sloping to rolling. They formed in sandy eolian material. They are on dunes and are excessively drained. Typically, the surface layer is grayish brown, loose fine sand about 5 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is pale brown in the upper part and very pale brown in the lower part.

Els soils are nearly level. They formed in sandy eolian and alluvial material. They are in sandhill valleys and are somewhat poorly drained. They are subject to rare flooding. Depth to the seasonal high water table ranges from about 1.5 feet in wet years to about 3.0 feet in dry years. Typically, the surface layer is dark gray, very friable loamy sand about 7 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is very pale brown in the upper part and light gray and mottled in the lower part.

Ipage soils are nearly level and very gently sloping. They formed in sandy eolian and alluvial material. They are in sandhill valleys between areas of the Els and Valentine soils. Ipage soils are moderately well drained. Depth to the seasonal high water table ranges from about 3 feet in wet years to about 6 feet in dry years. Typically, the surface layer is grayish brown, loose fine sand or loamy fine sand about 6 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 9 inches thick. The underlying material to a depth of 60 inches is very pale brown fine sand.

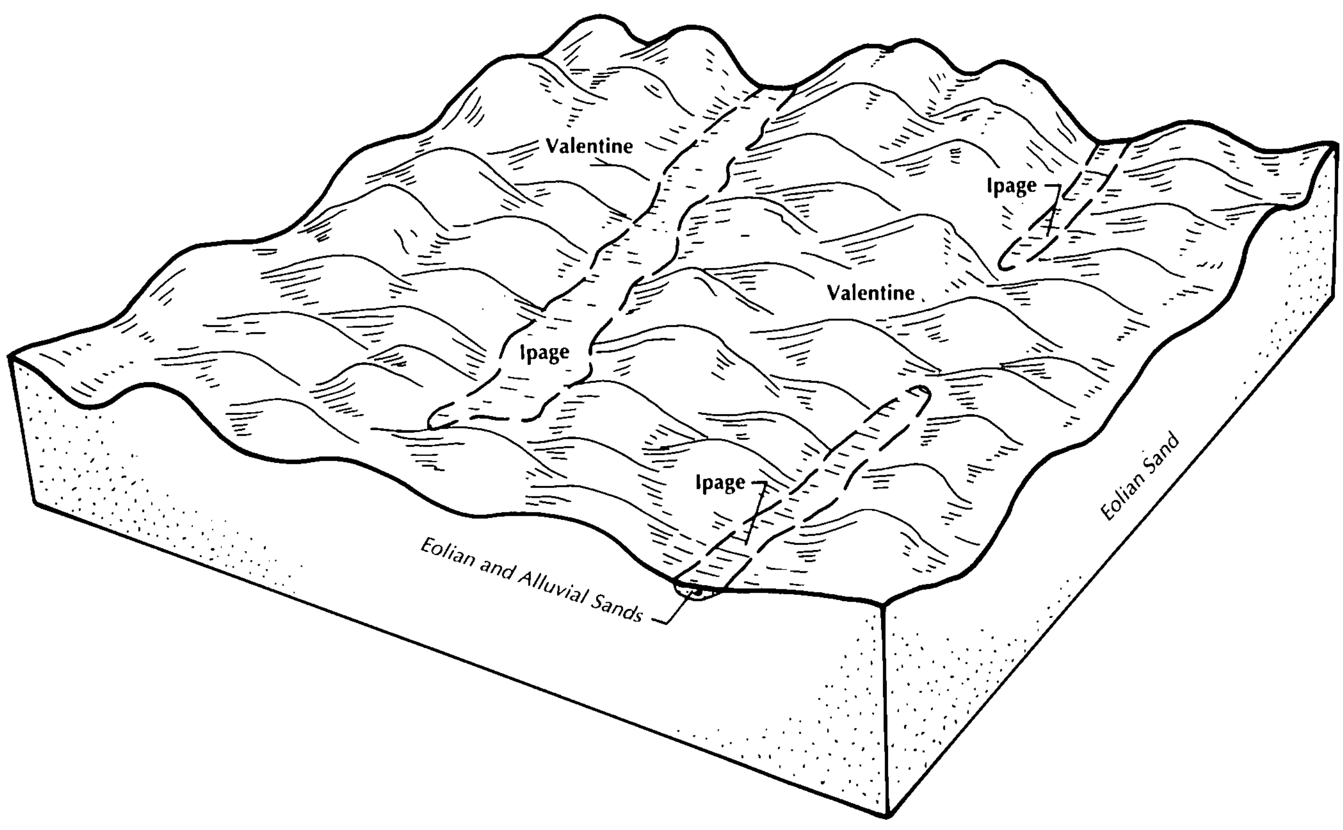

Figure 3.—Typical pattern of soils and parent material in the Valentine-Ipage association.

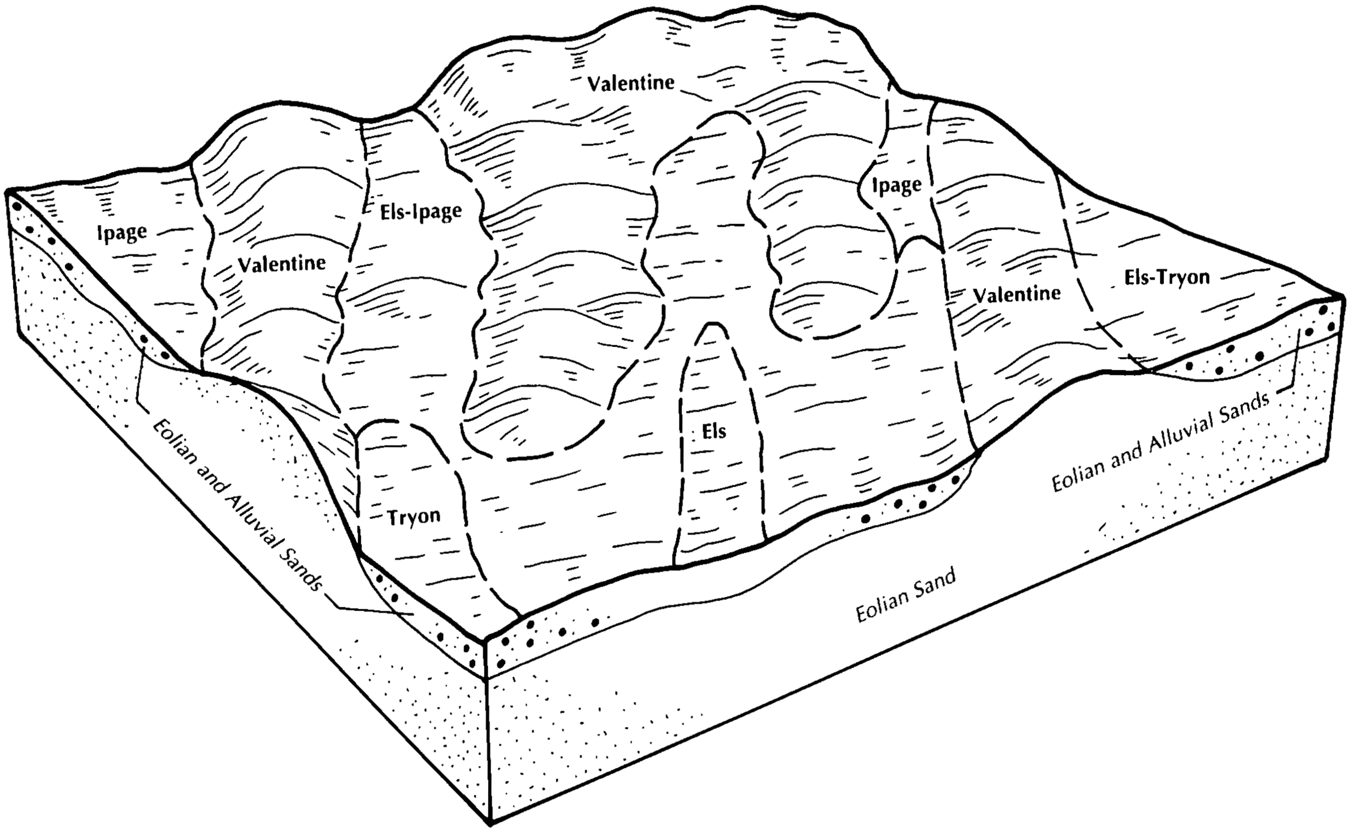

Figure 4.—Typical pattern of soils and parent material in the Valentine-Els-Ipage association.

Mottles are below a depth of 34 inches.

Of minor extent in this association are Dunn, Marlake, and Tryon soils. The well drained Dunn soils are on uplands and have loamy underlying material. Marlake soils are in the lowest landscape positions and are ponded for most of the growing season. Tryon soils are lower on the landscape than the Els soils and are poorly drained and very poorly drained. Also of minor extent are small areas of Blownout land, which are common on the Valentine soils throughout this association.

The major soils in this association mainly support native grasses and are used as range or hayland. A few areas are irrigated by sprinklers and are cultivated. Alfalfa and corn are the major irrigated crops. The soils are too sandy for dryland farming. Ranching is the main enterprise. Most ranches produce feeder calves and yearlings. Cultivated crops are used as feed for livestock. Wells produce good-quality water for livestock and irrigation purposes.

Soil blowing is a serious hazard on these soils, particularly in cultivated areas. Keeping crop residue on the surface and minimizing tillage help to control soil blowing and conserve moisture. The seasonal high water table in areas of the Els soils aids plant growth during dry periods but can cause severe wetness during periods of above normal rainfall. Efficiently using irrigation water and maintaining fertility are management needs. Management that includes proper haying methods and a planned grazing system helps to maintain or improve the range condition.

4. Valentine-Hersh-Gates Association

Deep, nearly level to very steep, excessively drained to well drained, sandy and loamy soils; on uplands

This association consists of soils on uplands. Some areas are hummocky. The soils formed in sandy and loamy eolian material and in loess. Slopes range from 0 to 60 percent.

The association includes about 4,630 acres, or 1 percent of the county. It is about 44 percent Valentine soils, 28 percent Hersh soils, 27 percent Gates soils, and 1 percent minor soils (fig. 5).

Valentine soils are gently sloping to rolling. They formed in sandy eolian material. They are on dunes and

are excessively drained. Typically, the surface layer is grayish brown, loose fine sand or loamy fine sand about 5 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is pale brown in the upper part and very pale brown in the lower part.

Hersh soils are nearly level to very steep. They formed in sandy and loamy eolian material. They are in swales and on side slopes in the uplands and are well drained to excessively drained. Typically, the surface layer is grayish brown, very friable fine sandy loam about 10 inches thick. Below this is a transitional layer of light brownish gray, very friable fine sandy loam about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray loamy very fine sand.

Gates soils are nearly level to very steep. They formed in loamy material. They are on upland side slopes along intermittent drains and in swales. They are well drained to excessively drained. Typically, the surface layer is grayish brown, very friable very fine sandy loam about 6 inches thick. Below this is a transitional layer of pale brown, very friable very fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is very pale brown very fine sandy loam. Lime is below a depth of about 15 inches.

Of minor extent in this association are the moderately well drained Ipage soils in sandhill swales.

The major soils in this association mainly support native grasses and are used as range or hayland. Some areas are used for cultivated crops. These areas generally are irrigated. Corn and alfalfa are the major crops. Ranching is the major enterprise. Most of the cultivated crops are used as feed for livestock. Wells produce a sufficient amount of good-quality water for livestock and irrigation purposes.

Soil blowing and water erosion are the main hazards in cultivated areas of these soils. Low rainfall is a limitation for dryland farming. Leaving crop residue on the surface and applying a system of conservation tillage help to control soil blowing and water erosion and conserve soil moisture. Efficiently using irrigation water and maintaining fertility are management needs. Management that includes proper grazing use, timely deferment of grazing or haying, and a planned grazing

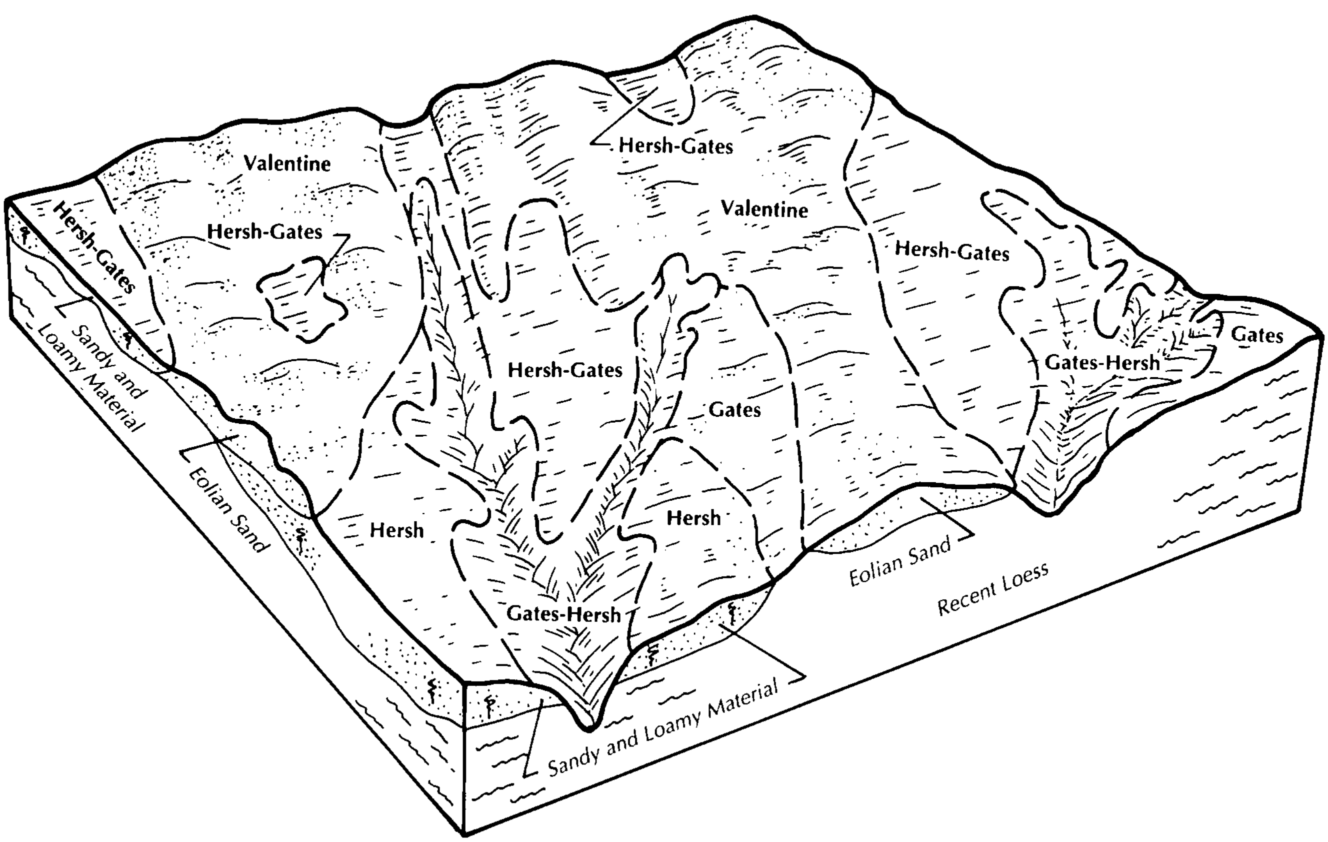

Figure 5.—Typical pattern of soils and parent material in the Valentine-Hersh-Gates association.

system helps to maintain or improve the range condition.

5. Ipage-Valentine-Simeon Association

Deep, nearly level to strongly sloping, moderately well drained and excessively drained, sandy soils; on uplands and stream terraces

This association consists of soils on uplands and stream terraces along the North Loup River. Slopes range from 0 to 9 percent.

The association includes about 19,110 acres, or 4 percent of the county. It is about 38 percent Ipage soils, 32 percent Valentine soils, 25 percent Simeon soils, and 5 percent minor soils.

Ipage soils are nearly level and very gently sloping. They formed in sandy eolian and alluvial material. They are on stream terraces and are moderately well drained. Depth to the seasonal high water table ranges from about 3.5 feet in wet years to about 6.0 feet in dry years. Typically, the surface layer is dark grayish brown, very friable sand or loamy fine sand about 6 inches thick. Below this is a transitional layer of grayish brown, loose sand about 3 inches thick. The upper part of the underlying material is light gray sand. The lower part to a depth of 60 inches or more is white coarse sand. Mottles are below a depth of 38 inches.

Valentine soils are very gently sloping to strongly sloping. They formed in sandy eolian material on uplands. They are excessively drained. Typically, the surface layer is grayish brown, loose fine sand about 6 inches thick. Below this is a transitional layer of brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is pale brown in the upper part and light gray in the lower part.

Simeon soils are nearly level and very gently sloping. They formed in sandy alluvium. They are on stream terraces and are excessively drained. Typically, the surface layer is grayish brown, very friable sand about 5 inches thick. Below this is a transitional layer of light brownish gray, loose sand about 9 inches thick. The underlying material to a depth of 60 inches or more is very pale brown and white coarse sand.

Of minor extent in this association are Els, Sandose, and Tryon soils. Els soils are lower on the landscape than the Ipage soils and are somewhat poorly drained. Sandose soils are sandy in the upper part and loamy in the lower part. They are well drained and are in swales between areas of the Valentine soils. Tryon soils are lower on the landscape than the Els soils. They are poorly drained and very poorly drained.

The major soils in this association mainly support native grasses and are used as range. A few areas are used for cultivated crops and are irrigated by sprinklers. Corn and alfalfa are the major crops. The soils are too droughty for dryland crops. Ranching is the major enterprise. Most of the cultivated crops are used as feed for livestock. Wells produce a sufficient amount of good-quality water for livestock and irrigation purposes.

Soil blowing is a serious hazard on these soils. Insufficient rainfall is a management concern. Controlling soil blowing and efficiently using irrigation water are management needs. Measures that maintain or improve fertility also are needed. Leaving crop residue on the surface and minimizing tillage help to control soil blowing and conserve moisture. The production of forage on the droughty Simeon soils varies greatly from year to year, depending on rainfall. Management that includes proper grazing use, timely deferment of grazing, and a planned grazing system helps to maintain or improve the range condition.

6. Almeria-Ipage-Fluvaquents Association

Deep, nearly level and very gently sloping, very poorly drained, poorly drained, and moderately well drained, sandy soils; on bottom land and stream terraces

This association consists of soils on bottom land and stream terraces along the major drainageways. Slopes range from 0 to 3 percent.

The association includes about 17,400 acres, or 4 percent of the county. It is about 29 percent Almeria soils, 26 percent Ipage soils, 15 percent Fluvaquents, and 30 percent minor soils (fig. 6).

Almeria soils are nearly level. They formed in sandy alluvium. They are on bottom land and are poorly drained and very poorly drained. They are occasionally flooded or frequently flooded. The seasonal high water table ranges from about 0.5 foot above the surface in wet years to about 1.5 feet below the surface in dry years. Typically, the surface layer is stratified, gray, very friable loamy fine sand about 4 inches thick. The upper part of the underlying material is stratified light brownish gray and gray, mottled fine sand. The lower part to a depth of 60 inches or more is stratified, white sand.

Ipage soils are nearly level and very gently sloping. They formed in sandy eolian and alluvial material. They are on stream terraces and are moderately well drained. Depth to the seasonal high water table ranges from about 3.5 feet in wet years to about 6.0 feet in dry years. Typically, the surface layer is dark grayish brown, loose sand or loamy fine sand about 6 inches thick. Below this is a transitional layer of grayish brown, loose sand about 3 inches thick. The upper part of the underlying material is light gray sand. The lower part to a depth of 60 inches or more is white coarse sand.

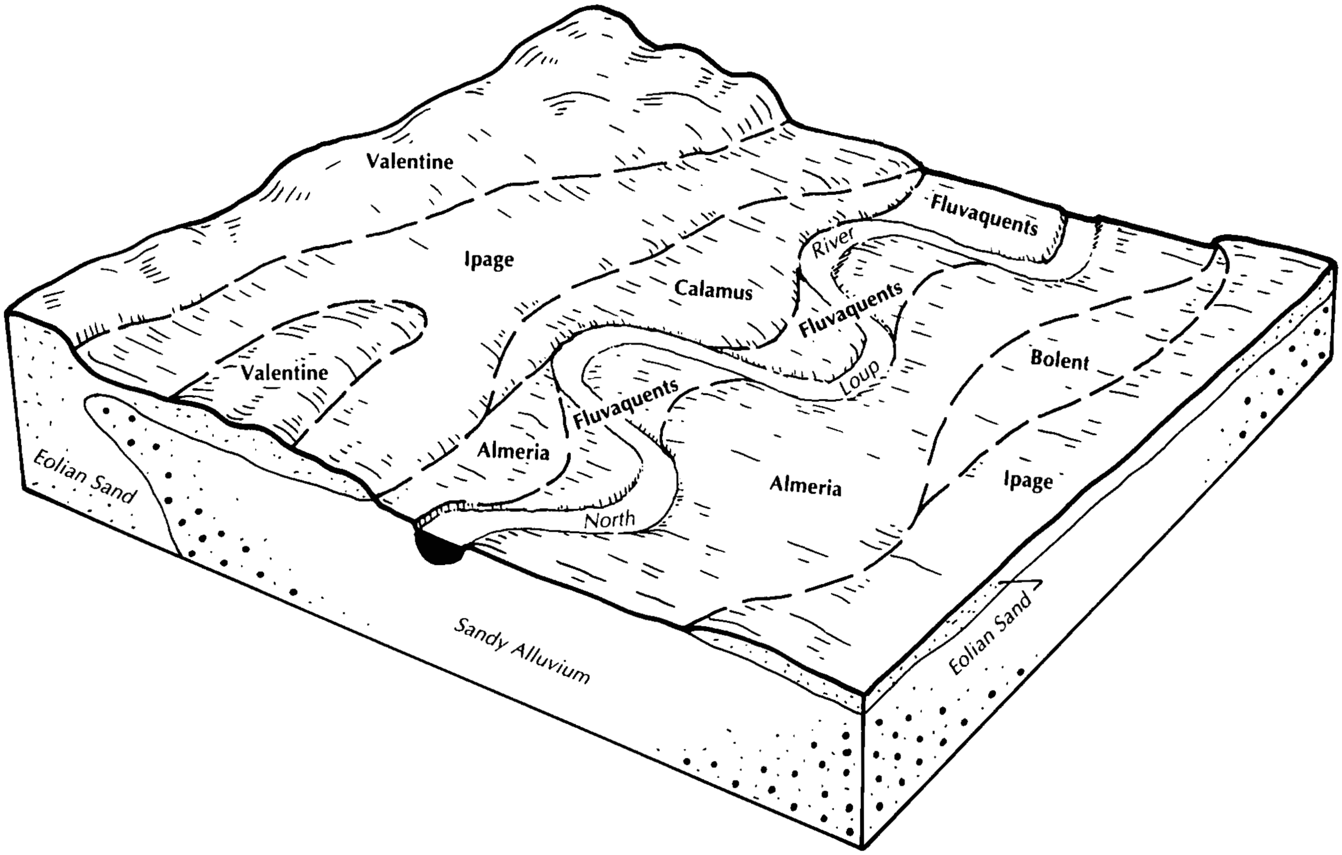

Figure 6.—Typical pattern of soils and parent material in the Almeria-Ipage-Fluvaquents association.

Mottles are below a depth of 38 inches.

Fluvaquents are nearly level. They formed in stratified, sandy alluvium. They are on bottom land and are very poorly drained. They are frequently flooded. The seasonal high water table may be 2 feet above the surface for most of the growing season but may drop to a depth of 1 foot in dry years. Typically, the surface is covered by a layer of decaying organic matter about 3 inches thick. The surface layer is stratified, light brownish gray, mottled, loose loamy fine sand about 2 inches thick. The underlying material to a depth of 60 inches or more is dominantly stratified gray to white, mottled fine sand and loamy fine sand. It has strata of coarse sand to fine sandy loam in the lower part. The texture and color of these soils and the thickness of the surface layer vary considerably from one area to another.

Of minor extent in this association are Bolent, Calamus, and Valentine soils. Bolent soils are higher on the landscape than the Almeria soils and are somewhat poorly drained. Calamus soils are in the slightly higher areas on bottom land and are subject to rare flooding. Valentine soils are on uplands and are excessively drained.

The major soils in this association support native grasses and are used as range or hayland. Areas covered with trees, shrubs, and forbs that tolerate excess water are used as habitat for wetland wildlife. Ranching is the main enterprise. Most ranches produce feeder calves and yearlings. Wells produce a sufficient amount of good-quality water for livestock.

The seasonal high water table is the main management concern if these soils are used as range or hayland. Flooding is a hazard. The high water table adversely affects haying in wet years. Some areas are dissected by shallow channels that are ponded during wet periods. Haying is difficult in these areas. The Fluvaquents are too wet for agricultural uses. They are best suited to habitat for wetland wildlife. Soil blowing may be a hazard on the Calamus soils if the surface is not protected. Management that includes proper haying methods, restricted use during wet periods, and a planned grazing system helps to maintain or improve the range condition.

7. Dunn-Josburg-Valentine Association

Deep, nearly level to steep, moderately well drained and excessively drained, sandy soils; on uplands

This association consists of soils that have a sandy surface layer on uplands. Slopes range from 0 to 24 percent.

The association includes about 4,451 acres, or 1 percent of the county. It is about 41 percent Dunn soils, 33 percent Josburg soils, 13 percent Valentine soils, and 13 percent minor soils.

Dunn soils are nearly level to moderately steep. They formed in sandy eolian material overlying loamy alluvium. They are moderately well drained. Typically, the surface layer is gray, very friable loamy fine sand about 7 inches thick. The subsurface layer is grayish brown, very friable loamy fine sand about 7 inches thick. The transitional layer is light brownish gray, loose fine sand about 5 inches thick. The underlying material is pale brown, mottled, loose fine sand about 9 inches thick. The next 12 inches is light brownish gray, firm loam. Below this to a depth of 60 inches or more is light gray loam.

Josburg soils are nearly level to strongly sloping. They formed in loamy material overlying alluvial sediment. They are moderately well drained. Typically, the surface layer is grayish brown, very friable loamy fine sand about 7 inches thick. The subsoil is light brownish gray, firm loam about 11 inches thick. The underlying material to a depth of 60 inches or more is fine sandy loam. It is light gray in the upper part and white in the lower part.

Valentine soils are gently sloping to steep. They formed in sandy eolian material on dunes and are excessively drained. Typically, the surface layer is grayish brown, very friable loamy fine sand or fine sand about 6 inches thick. Below this is a transitional layer of pale brown, very friable loamy fine sand or fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand.

Of minor extent in this association are Els, Ipage, and Sandose soils. Els and Ipage soils are sandy. They are lower on the landscape than the Dunn soils. Els soils are somewhat poorly drained, and Ipage soils are moderately well drained. Sandose soils are in landscape positions similar to those of the Dunn soils and are well drained.

The major soils in this association mainly support native grasses and are used as range or hayland. Ranching is the main enterprise. A large acreage is used for irrigated crops. A sprinkler system is the best method of irrigation. A few small areas are used for dryland crops. Corn and alfalfa are the major crops. Most of the cultivated crops are used as feed for livestock. Wells produce a sufficient amount of good-quality water for livestock and irrigation purposes.

Soil blowing and water erosion are the main hazards in cultivated areas of these soils. The perched water table in the Dunn soils can cause problems during wet periods. Leaving crop residue on the surface and applying a system of conservation tillage help to control soil blowing and water erosion. Efficiently using irrigation water and maintaining fertility are management needs. Management that includes proper grazing use, proper haying methods, timely deferment of grazing or haying, and a planned grazing system helps to maintain or improve the range condition.

8. Vetal-Sandose Association

Deep, nearly level to gently sloping, well drained, loamy and sandy soils; on stream terraces

This association consists of well drained soils on stream terraces along the North Loup River. Slopes range from 0 to 6 percent.

The association includes about 4,250 acres, or 1 percent of the county. It is about 42 percent Vetal soils, 25 percent Sandose soils, and 33 percent minor soils.

Vetal soils are nearly level to gently sloping. They formed in loamy and sandy alluvium. Typically, the surface layer is dark grayish brown, very friable very fine sandy loam or loamy fine sand about 7 inches thick. The subsurface layer is dark gray, very friable very fine sandy loam about 15 inches thick. Below this is a transitional layer of light gray, very friable, calcareous very fine sandy loam about 5 inches thick. The upper part of the underlying material is light brownish gray, calcareous, loamy fine sand. The lower part to a depth of 60 inches or more is light gray sand.

Sandose soils are nearly level and very gently sloping. They formed in sandy eolian material overlying loamy material. Typically, the surface layer is dark brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is grayish brown, very friable loamy fine sand about 6 inches thick. The subsoil is about 25 inches thick. It is brown, loose fine sand in the upper part; dark grayish brown, very friable very fine sandy loam in the next part; and grayish brown, very friable very fine sandy loam in the lower part. The underlying material to a depth of 60 inches or more is light brownish gray very fine sandy loam.

Of minor extent in this association are Ipage, Simeon, Jansen, and Valentine soils. Ipage soils are sandy and are moderately well drained. They are lower on the landscape than the Vetal and Sandose soils. Simeon soils are sandy. They are on breaks of the stream terrace and are excessively drained. Valentine soils are sandy. They are higher on the landscape than

the Vetal soils. Jansen soils have more clay than the major soils. They are in landscape positions similar to those of the Sandose soils.

The major soils in this association are used mainly for irrigated crops. A large acreage supports native grasses and is used as range or hayland. Sprinkler and gravity irrigation systems are suitable. Corn and alfalfa are the major crops. Wells produce good-quality water for livestock and irrigation purposes.

Efficiently using irrigation water is the main management need. Conserving moisture and controlling soil blowing are additional management concerns. Maintaining crop residue on the surface and applying a system of conservation tillage help to control soil blowing and conserve soil moisture. Management that includes proper grazing use and a planned grazing system helps to maintain or improve the range condition.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Ipage fine sand, 0 to 3 percent slopes, is a phase of the Ipage series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Els-Ipage complex, 0 to 3 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Blownout land is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinements in series concepts, different slope groupings, and the application of the latest soil classification system.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils.

Soil Descriptions

Ab—Almeria loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, poorly drained soil formed in sandy alluvium on bottom land. It is occasionally flooded. Areas generally are long and narrow and range from 5 to more than 100 acres in size.

Typically, the surface layer is stratified, gray, very friable loamy fine sand about 4 inches thick. The upper part of the underlying material is stratified light brownish gray and gray, mottled fine sand. The lower part to a depth of 60 inches or more is stratified, white sand. In places the dark surface soil is more than 10 inches thick. In some of the low areas and drainageways, water may cover the surface for a few days in spring and in other wet periods.

Included with this soil in mapping are small areas of

Bolent and Calamus soils and small areas of Fluvaquents. Bolent and Calamus soils are slightly higher on the landscape than the Almeria soil and are better drained. Fluvaquents are in the lower areas and are ponded during most of the growing season. Included soils make up 10 to 15 percent of this unit.

Permeability is rapid in the Almeria soil, and the available water capacity is low. The organic matter content is moderately low. Runoff is very slow. The seasonal high water table ranges from the surface in wet years to a depth of about 1.5 feet in dry years. It may drop to a depth of about 2 or 3 feet in late summer.

Nearly all of the acreage supports native grasses and is used as range or hayland. This soil is too wet for use as cropland.

If this soil is used as range, the climax vegetation is dominantly prairie cordgrass, switchgrass, big bluestem, and various sedges. These species make up 75 percent or more of the total annual forage. Reedgrass, other perennial grasses, and forbs make up the rest. Introduced grasses, such as creeping foxtail, are part of the plant community in places. If subject to continuous heavy grazing or improperly harvested for hay, prairie cordgrass, switchgrass, and big bluestem decrease in abundance. Initially, these species are replaced by slender wheatgrass, western wheatgrass, plains muhly, and various sedges. Timothy, redtop, and clover also increase in abundance if they have been overseeded. If overgrazing or improper haying continues for many years, bluegrass, western wheatgrass, foxtail barley, and various sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is about 1.9 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during very wet periods helps to maintain or improve the range condition. This soil is generally the first to be overgrazed when it is in a pasture that includes better drained, sandy soils. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Overgrazing and operating heavy machinery when the soil is wet cause surface compaction and the formation of small mounds and ruts, which make harvesting hay and grazing difficult.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous and healthy. Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be changed in successive years. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in spring, before the ground thaws and the water table reaches a high level.

This soil is suited to the trees and shrubs grown as windbreaks. The high water table is the main limitation. The only suitable species are those that can tolerate the seasonal high water table. Preparing the site and planting in spring may not be possible until the water table drops and the soil is sufficiently dry. Weeds and undesirable grasses that compete with the trees can be controlled by cultivating between the tree rows when the water table is at its lowest level.

This soil is not suitable as a site for septic tank absorption fields and dwellings because of the flooding and the wetness. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. Constructing local roads on suitable, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding and wetness.

The land capability unit is Vw-7, dryland; Wet Subirrigated range site; windbreak suitability group 2D.

Ac—Almeria loamy fine sand, wet, 0 to 2 percent slopes. This deep, nearly level, very poorly drained soil formed in sandy alluvium on bottom land. It is occasionally flooded. It has a very high water table and is commonly ponded in spring and in other wet periods. Areas generally are long and narrow and range from 5 to 200 acres in size.

Typically, the surface layer is about 6 inches of gray, very friable loamy fine sand that has thin strata of fine sandy loam and fine sand. The upper part of the underlying material is light gray fine sand. The next part is gray fine sandy loam. The lower part to a depth of 60 inches or more is white sand. The underlying material has thin strata of finer and coarser textures and has yellowish brown mottles. In some places the surface layer is fine sand or fine sandy loam. In other places the dark surface soil is more than 10 inches thick.

Included with this soil in mapping are small areas of Bolent and Calamus soils and small areas of Fluvaquents. Bolent and Calamus soils are slightly higher on the landscape than the Almeria soil and are better drained. Fluvaquents are lower on the landscape than the Almeria soil and are ponded during most of the growing season. Included soils make up 5 to 15 percent of this unit.

Permeability is rapid in the Almeria soil, and the available water capacity is low. The organic matter content is moderately low. Runoff is very slow or ponded. The seasonal high water table is about 0.5 foot above the surface in wet years to about 1.0 foot below the surface in dry years. It normally drops to a depth of

about 1 to 2 feet by late summer.

Most of the acreage supports native grasses and is used as range or hayland. This soil is too wet for use as cropland.

If this soil is used as range or hayland, the climax vegetation is dominantly prairie cordgrass, northern reedgrass, bluejoint reedgrass, and various sedges. These species make up 75 percent or more of the total annual forage. Rushes, slender wheatgrass, and other perennial grasses and forbs make up the rest. Introduced grasses, such as reed canarygrass and creeping foxtail, are part of the plant community in places. If subject to continuous heavy grazing or improperly harvested for hay, prairie cordgrass, bluejoint reedgrass, northern reedgrass, and reed canarygrass decrease in abundance. Initially, these species are replaced by slender wheatgrass, plains bluegrass, green muhly, and various sedges, rushes, and forbs. If overgrazing or improper haying continues for many years, bluegrass, foxtail barley, and various sedges, rushes, and forbs dominate the site.

In most areas of this soil in Blaine County, the range is in good condition. The suggested initial stocking rate is about 1.5 animal unit months per acre. The soil produces a high quantity of low-quality forage. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use in very wet periods helps to maintain or improve the range condition. Overgrazing and operating heavy machinery when the soil is wet cause surface compaction and the formation of small mounds and ruts, which make harvesting hay and grazing difficult.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. In wetter years, some areas of hay cannot be harvested. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in spring, before the ground thaws and the water table reaches a high level.

This soil is unsuited to the trees and shrubs grown as windbreaks. The high water table is the main limitation. Water-tolerant trees and shrubs for recreational areas or wildlife habitat or for forestation can be established in a few areas. Hand planting or other special management is needed.

This soil is not suitable as a site for septic tank absorption fields or dwellings because of the ponding and the flooding. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. Constructing local roads on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding and wetness.

The land capability unit is Vw-7, dryland; Wetland range site; windbreak suitability group 10.

Ad—Almeria loamy fine sand, channeled. This deep, nearly level, very poorly drained soil formed in sandy alluvium on bottom land. It is frequently flooded. Areas generally are long and narrow and range from 5 to 100 acres in size.

Typically, the surface layer is about 3 inches of dark gray, very friable loamy fine sand that has strata of fine sandy loam. The upper part of the underlying material is stratified light gray and dark gray, mottled sand and loamy fine sand. The next part is light gray, stratified fine sand and fine sandy loam. The lower part to a depth of 60 inches or more is white sand. In places the surface layer is fine sand or fine sandy loam.

Included with this soil in mapping are small areas of Bolent and Calamus soils and small areas of Fluvaquents. Bolent and Calamus soils are higher on the landscape than the Almeria soil and are better drained. Fluvaquents are lower on the landscape than the Almeria soil and are ponded during most of the growing season. Also included are a few areas of soils that have layers of organic material 4 to 15 inches thick in the underlying material and stream channels that contain water much of the year. Included soils make up 5 to 15 percent of this unit.

Permeability is rapid in the Almeria soil, and the available water capacity is low. The organic matter content is moderately low. Runoff is very slow. The seasonal high water table is about 0.5 foot above the surface in wet years to about 1.0 foot below the surface in dry years.

Most of the acreage supports woody vegetation and is used for limited grazing. This soil is unsuited to cropland because of the wetness. In most areas the dominant vegetation is cottonwood, willow, dogwood, and indigobush. This soil is poorly suited to range. In areas of range, the native plant community is mostly tall and mid grasses, predominantly prairie cordgrass, bluejoint reedgrass, northern reedgrass, and various sedges. Overgrazing when the soil is wet can cause the formation of small mounds, which make grazing difficult.

This soil is best suited to wildlife habitat. Trees and shrubs provide nesting sites and cover for a variety of openland and wetland wildlife. Deer, mink and other furbearing animals, herons and other waterfowl, and shore birds are common. The stream channels provide fresh water for wildlife in most years.

This soil is not suited to the trees and shrubs grown as windbreaks. Suitable trees and shrubs for recreational areas or wildlife habitat or for forestation can be established in some small areas if the species selected for planting are those that can withstand

wetness. Hand planting or other special management is needed.

This soil is generally not suitable as a site for sanitary facilities or building site development because of the ponding and the flooding. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. Constructing local roads on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding and wetness.

The land capability unit is VIw-7, dryland; windbreak suitability group 10. No range site is assigned.

Bg—Blownout land-Valentine complex, 6 to 60 percent slopes. This map unit is in the sandhills. It formed in sandy eolian material. Blownout land is in bowllike depressions that have been hollowed out by the wind (fig. 7). The depressions range from 5 to more than 50 feet in depth. Some have been eroded to a permanent water table. The deep, excessively drained Valentine soil is adjacent to the areas of Blownout land. Areas of this unit range from 5 to 100 acres in size. They are 50 to 80 percent Blownout land and 20 to 50 percent Valentine soil.

The Blownout land to a depth of 60 inches or more is very pale brown, loose fine sand that shifts easily as the wind blows. In most areas it does not support vegetation.

Typically, the Valentine soil has a surface layer of light brownish gray, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. In many places the surface layer is very pale brown, loose sand about 2 to 12 inches thick.

Included in this unit in mapping are small areas of Tryon and Marlake soils at the bottom of blowouts. These included soils are poorly drained and very poorly drained. They make up 5 to 10 percent of this unit.

Permeability is rapid in the Blownout land and the Valentine soil, and the available water capacity is low. The organic matter content is very low in the Blownout land and low in the Valentine soil. Runoff is slow on the Blownout land and the Valentine soil.

This unit is suited to range. It is not suitable as cropland. The vegetation is sparse and grows only on the Valentine soil.

In areas used as range, the climax vegetation on the Valentine soil is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage on this soil. Switchgrass, sand lovegrass, blue grama, sedges, and forbs make up the rest. If subject to continuous heavy grazing, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and the extent of Blownout land increases.

Productivity can be restored if the Blownout land is stabilized and native grass is reestablished. Most areas of Blownout land can be reclaimed in 4 or 5 years by implementing a planned grazing system that prevents excessive trampling and overgrazing by livestock. Establishing a stable grade on steep banks and controlling grazing patterns through a planned grazing system help to revegetate and stabilize these areas. Reducing the slope of the banks helps to control soil blowing during revegetation. After grasses are reestablished, range management is very effective in controlling soil blowing. A planned grazing system that includes proper grazing use, timely deferment of grazing, and control of grazing patterns helps to maintain or improve the range condition in stabilized areas.

The potential stocking rate on this unit varies and should be determined by onsite evaluation. The unit generally is in pastured areas where the range site is Sands or Choppy Sands. Locating water and salting facilities outside this unit helps to prevent excessive trampling, which can increase the extent of Blownout land.

This unit is not suited to the trees and shrubs grown as windbreaks. In the areas of Blownout land, the sand is loose and young seedlings can be damaged by windblown sand. The trees should be protected from the shifting sand. Suitable trees and shrubs for recreational areas or wildlife habitat or for forestation can be established in areas of the Valentine soil. Hand planting or other special management is needed.

This unit is generally not suitable as a site for septic tank absorption fields or building site development because of the slope. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. Cutting and filling are needed to provide a suitable grade for local roads.

The land capability unit is VIIe-5, dryland; windbreak suitability group 10. The Valentine soil is in the Sands range site. Blownout land is not assigned a range site.

Bo—Bolent loamy sand, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil formed in sandy alluvium on bottom land along the major streams. It is occasionally flooded for short periods of time. Most areas are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is dark gray, very friable loamy sand about 5 inches thick. The upper part of the underlying material is light brownish gray fine sand. The lower part to a depth of 60 inches or more is white,

Figure 7.—Typical area of Blownout land-Valentine complex, 6 to 60 percent slopes.

mottled fine sand and sand. The underlying material is stratified with loamy fine sand and fine sandy loam. In places the dark surface soil is more than 10 inches thick. In a few places the surface layer is fine sandy loam or loam. In a few areas the surface soil is fine sand that is 6 to 24 inches thick.

Included with this soil in mapping are small areas of Almeria and Calamus soils and small areas of Fluvaquents. Almeria soils and Fluvaquents are lower on the landscape than the Bolent soil. Almeria soils are poorly drained, and Fluvaquents are very poorly drained. Calamus soils are higher on the landscape than the Bolent soil and are moderately well drained. Included soils make up 10 to 15 percent of this unit.

Permeability is rapid in the Bolent soil, and the available water capacity is low. The organic matter content also is low. Runoff is slow. The water intake rate is very high. Depth to the seasonal high water table ranges from about 1.5 feet in wet years to about 3.5 feet in dry years. The water table normally drops to a depth of 4 to 6 feet during the summer.

Most of the acreage supports native grasses and is used as range or hayland. A few areas are cultivated.

If dry-farmed, this soil is poorly suited to corn, small grain, and introduced grasses. The flooding may delay planting in spring and limit the production of small grain. Alfalfa is suited to areas where the water table is not too high. The soil may be difficult to work in spring because of the wetness caused by the high water table. Planting alfalfa and other close-growing crops eliminates the need for working the soil in spring and helps to control soil blowing when the surface is dry. Stubble mulch tillage and a cropping system that maintains a cover of crop residue help to control soil blowing. Returning crop residue to the soil and adding barnyard manure increase the content of organic matter and improve fertility.

If irrigated, this soil is poorly suited to corn and small grain. It is too sandy for gravity irrigation. A sprinkler system is the best method of irrigation. Frequent, light

applications of water help to prevent the leaching of plant nutrients. The seasonal high water table is a management concern during wet periods. Conservation tillage and winter cover crops help to control soil blowing. Applying barnyard manure increases the content of organic matter and improves fertility.

If this soil is used as range or hayland, the climax vegetation is dominantly big bluestem, indiangrass, little bluestem, and switchgrass. These species make up 70 percent or more of the total annual forage. Prairie cordgrass, sedges, annual grasses, and forbs make up the rest. If continuously grazed or improperly harvested for hay, big bluestem, little bluestem, indiangrass, switchgrass, and prairie cordgrass decrease in abundance and are replaced by sideoats grama, western wheatgrass, bluegrass, slender wheatgrass, green muhly, sedges, and rushes. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.7 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during wet periods helps to maintain or improve the range condition. This soil is generally the first to be overgrazed when it is in a pasture that includes better drained, sandy soils. Properly located fences, livestock water, and salting facilities result in a more uniform distribution of grazing. Areas that formerly were cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The hay is of best quality when the grasses are cut early. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in spring, before the ground thaws.

This soil is suited to the trees and shrubs grown as windbreaks. The only suitable species are those that can tolerate the seasonal high water table. Establishing seedlings and cultivating between the tree rows can be difficult in wet years. Weeds and undesirable grasses are a concern because they compete with the trees for moisture. They can be controlled by cultivation between the tree rows with conventional equipment and by timely applications of appropriate herbicide.

This soil is not suitable as a site for septic tank absorption fields or buildings because of the flooding and the wetness. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. Constructing local roads on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding.

The land capability units are IVw-5, dryland, and IVw-11, irrigated; Subirrigated range site; windbreak suitability group 2S.

Cm—Calamus loamy sand, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil formed in sandy alluvium on bottom land. It is subject to rare flooding. Some areas are dissected by shallow drainage channels. Areas range from 10 to 300 acres in size.

Typically, the surface layer is grayish brown, very friable loamy sand about 4 inches thick. The subsurface layer is dark gray, very friable loamy fine sand about 4 inches thick. The upper part of the underlying material is light gray sand. The lower part to a depth of 60 inches is white sand stratified with coarse sand. It has dark yellowish brown mottles. In some places the surface layer is fine sandy loam, loamy fine sand, or sand. In other places the dark surface soil is more than 10 inches thick. In some areas the underlying material has strata of loam and fine sandy loam.

Included with this soil in mapping are small areas of Bolent and Almeria soils and small areas of Fluvaquents. These included soils are lower on the landscape than the Calamus soil and are somewhat poorly drained to very poorly drained. They make up 10 to 15 percent of this unit.

Permeability is rapid in the Calamus soil, and the available water capacity is low. The organic matter content also is low. Runoff is slow. The water intake rate is very high. Depth to the seasonal high water table ranges from about 3 feet in wet years to about 6 feet in dry years.

Most of the acreage supports native grasses and is used as range or hayland. A few areas are used as irrigated cropland.

If irrigated, this soil is poorly suited to corn, alfalfa, and introduced grasses. A sprinkler system is the best method of irrigation. Frequent, light applications of irrigation water are needed because of the low available water capacity. These applications help to prevent the excessive leaching of plant nutrients. Returning crop residue to the soil and adding barnyard manure increase the content of organic matter and improve fertility. Crop residue left on the surface helps to control soil blowing.

If this soil is used as range or hayland, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and switchgrass. These species make up 75 percent or more of the total annual forage. Needleandthread, indiangrass, sedges, and other annual and perennial grasses and forbs make up the

rest. If subject to continuous heavy grazing, sand bluestem, indiangrass, little bluestem, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result soil blowing is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas that formerly were cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks. Young seedlings can be damaged by windblown sand. Soil blowing can be controlled by maintaining strips of sod or an annual cover crop between the tree rows. Cultivation generally should be restricted to the tree rows. Irrigation is needed during dry periods. Areas close to the trees can be rototilled or hoed by hand.

The flooding is a hazard if this soil is used as a site for buildings. Wetness is a limitation for septic tank absorption fields. Adding fill material can raise the absorption field a sufficient distance above the seasonal high water table. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. Dwellings with basements can be constructed on raised, well compacted fill material, which increases the depth to the seasonal high water table. The damage to local roads caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-14, irrigated; Sandy range site; windbreak suitability group 7.

DxB—Dunn loamy fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, moderately well drained soil formed in sandy eolian material overlying loamy sediments on uplands. Areas range from 10 to 200 acres in size.

Typically, the surface layer is gray, very friable loamy fine sand about 7 inches thick. The subsurface layer is grayish brown, very friable loamy fine sand about 7 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 5 inches thick. The underlying material is pale brown, mottled, loose fine sand about 9 inches thick. The next 12 inches is light brownish gray, friable loam. Below this to a depth of 60 inches or more is light gray loam. In some areas the surface layer is loamy sand or sand. In a few areas sandy material is below a depth of 40 inches.

Included with this soil in mapping are small areas of Ipage and Sandose soils. Ipage soils are in landscape positions similar to those of the Dunn soil and are sandy throughout. Sandose soils are higher on the landscape than the Dunn soil and are well drained. Included soils make up 10 to 15 percent of this unit.

Permeability is rapid in the upper part of the Dunn soil and moderately slow or slow in the lower part. The available water capacity is moderate. The organic matter content is moderately low. Runoff is slow. The water intake rate is high. Depth to a perched seasonal high water table ranges from 1.5 to 3.5 feet in early spring.

Most of the acreage supports native grasses and is used as range or hayland. A small acreage is used as cropland, some of which is irrigated.

If dry-farmed, this soil is poorly suited to corn, small grain, and alfalfa. Small grain and the first cutting of alfalfa are generally better suited than other crops because they grow and mature in spring, when the amount of rainfall is higher. Soil blowing is a serious hazard. Windblown sandy material can destroy young seedlings in early spring. A cropping system that maintains a cover of crops, crop residue, or grass helps to control soil blowing, conserve moisture, and maintain fertility and the content of organic matter.

If irrigated, this soil is suited to corn, alfalfa, and introduced grasses. This soil is not suited to gravity irrigation because it is too sandy. A sprinkler system is the best method of irrigation. Frequent, light applications of water are needed because of the high rate of water intake. These applications also help to prevent the excessive leaching of plant nutrients. Returning plant residue to the soil and adding barnyard manure increase the content of organic matter and improve fertility. Leaving crop residue on the surface helps to control soil blowing.

If this soil is used as range or hayland, the climax vegetation is dominantly big bluestem, needleandthread, switchgrass, little bluestem, and prairie sandreed. These species make up 60 percent of

the total annual forage. Blue grama, purple lovegrass, Kentucky bluegrass, prairie junegrass, indiangrass, sedges, and forbs make up the rest. If subject to continuous heavy grazing, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, blue grama, sedges, and forbs. If overgrazing continues for many years, blue grama, prairie junegrass, Kentucky bluegrass, sedges, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks if soil blowing is controlled by maintaining strips of sod or other vegetation between the tree rows. The droughtiness and competition for moisture from grasses and weeds are problems. Irrigation is needed during dry periods. Cultivating by hand or applying appropriate herbicide helps to control weeds and grasses.

If this soil is used as a site for septic tank absorption fields, fill material is needed to raise the absorption field a sufficient distance above the water table. The moderately slow or slow permeability is an additional limitation. It generally can be overcome by increasing the size of the absorption field. The sides of shallow excavations can cave in unless they are shored. Dwellings with basements should be built on raised, well compacted fill material, which helps to overcome the wetness. The foundations of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Constructing local roads on suitable, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by wetness. The damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-6, dryland, and IIIe-10, irrigated; Sandy Lowland range site; windbreak suitability group 5.

DxF—Dunn loamy fine sand, 9 to 20 percent slopes. This deep, moderately steep, moderately well drained soil is on the sides of drainageways that dissect the uplands. It formed in sandy eolian material overlying loamy sediments. Areas range from 5 to 100 acres in size.

Typically, the surface layer is gray, very friable loamy fine sand about 6 inches thick. The subsurface layer is grayish brown, loose loamy fine sand about 5 inches thick. The underlying material is light brownish gray, mottled, loose fine sand about 13 inches thick. The next 10 inches is light brownish gray, firm loam. Below this to a depth of 60 inches or more is light gray sandy loam. In some areas the surface layer is sand, fine sand, or loamy sand. In places sandy material is below a depth of 40 inches.

Included with this soil in mapping are small areas of Hersh and Valentine soils. These included soils are higher on the landscape than the Dunn soil. Hersh soils have more sand in the underlying material than the Dunn soil. Valentine soils are excessively drained. Included soils make up 10 to 15 percent of this unit.

Permeability is rapid in the upper part of the Dunn soil and moderately slow or slow in the lower part. The available water capacity is moderate. The organic matter content is moderately low. Runoff is slow. Depth to a perched seasonal high water table ranges from 1.5 to 3.5 feet in spring.

All of the acreage supports native grasses and is used as range or hayland. This soil is not suitable as cropland.

If this soil is used as range or hayland, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 80 percent or more of the total annual forage. Blue grama, switchgrass, annual grasses, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, prairie sandreed, sedges, annual grasses, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing and water erosion are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas

previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks if soil blowing is controlled by maintaining strips of sod or other vegetation between the tree rows. The droughtiness and competition for moisture from grasses and weeds are problems. Cultivating by hand or applying appropriate herbicide helps to control weeds and grasses.

The wetness and the slow permeability are hazards if this soil is used for septic tank absorption fields. Adding fill material can raise the absorption field a sufficient distance above the seasonal high water table. Increasing the size of the absorption field helps to overcome the moderately slow or slow permeability. The sides of shallow excavations can cave in unless they are shored. They should be shored during dry periods. Dwellings should be constructed on raised, well compacted fill material, which helps to overcome the wetness. Constructing local roads on suitable, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by wetness. The damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Coarser grained base material can be used to ensure better performance.

The land capability unit is VIe-6, dryland; Sandy range site; windbreak suitability group 7.

DzD—Dunn-Josburg loamy fine sands, 3 to 9 percent slopes. These deep, gently sloping and strongly sloping, moderately well drained soils are on uplands. The Dunn soil formed in sandy eolian material overlying loamy sediments, and the Josburg soil formed in loamy sediments. These soils are in similar positions on the landscape. Areas range from 10 to more than 200 acres in size. They are 50 to 65 percent Dunn soil and 20 to 35 percent Josburg soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Dunn soil has a surface layer of grayish brown, very friable loamy fine sand about 8 inches thick. The subsurface layer is dark grayish brown, very friable loamy fine sand about 3 inches thick. The underlying material is pale brown, mottled, very friable loamy fine sand about 13 inches thick. The next 12 inches is very pale brown, firm loam. Below this to a depth of 60 inches or more is light gray loam. In some places the surface layer is sand, fine sand, or loamy sand. In other places sandy material is below a depth of 40 inches.

Typically, the Josburg soil has a surface layer of dark grayish brown, very friable loamy fine sand about 3 inches thick. The subsurface layer is brown, very friable loamy fine sand about 3 inches thick. The subsoil is pale brown, firm loam about 6 inches thick. The underlying material to a depth of 60 inches or more is light brown and very pale brown, stratified fine sandy loam and loam. In places the surface layer is fine sandy loam and is more than 10 inches thick.

Included with these soils in mapping are small areas of Valentine soils. These included soils are higher on the landscape than the Dunn and Josburg soils and are excessively drained. They make up 10 to 15 percent of this unit.

Permeability is rapid in the upper part of the Dunn soil and moderately slow or slow in the lower part. It is moderately slow in the Josburg soil. The available water capacity is moderate in both soils. The organic matter content is moderately low. Runoff is slow on the Dunn soil and medium on the Josburg soil. The water intake rate is high in both soils. In early spring, depth to a perched seasonal high water table ranges from 1.5 to 3.5 feet in the Dunn soil and from 3.0 to 6.0 feet in the Josburg soil.

Most of the acreage supports native grasses and is used as range or hayland. A large acreage is used as irrigated cropland. These soils are not suited to dryland crops because of a severe hazard of soil blowing.

If irrigated, these soils are poorly suited to corn, alfalfa, and introduced grasses. They are not suited to gravity irrigation because of the slope. A sprinkler system is the best method of irrigation. Frequent, light applications of water help to prevent the leaching of plant nutrients. Returning crop residue to the soil and adding barnyard manure increase the content of organic matter and improve fertility. Leaving crop residue on the surface helps to control soil blowing.

In areas used as range or hayland, the climax vegetation on the Dunn soil is dominantly sand bluestem, needleandthread, little bluestem, and prairie sandreed. These species make up 80 percent or more of the total annual forage on this soil. Blue grama, purple lovegrass, Kentucky bluegrass, prairie junegrass, indiangrass, sedges, annual grasses, and forbs make up the rest. The climax vegetation on the Josburg soil is dominantly sand bluestem, little bluestem, and prairie sandreed. These species make up 60 percent or more of the total annual forage on this soil. Needleandthread, blue grama, switchgrass, annual grasses, forbs, and shrubs make up the rest.

If subject to continuous heavy grazing, big bluestem,

little bluestem, sand bluestem, indiangrass, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, prairie sandreed, sedges, annual grasses, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre on the Dunn soil and 0.9 animal unit month per acre on the Josburg soil. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

If these soils are used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

These soils are suited to the trees and shrubs grown as windbreaks if soil blowing is controlled by maintaining strips of sod or other vegetation between the tree rows. The droughtiness and competition for moisture from grasses and weeds are problems. Irrigation is needed during dry periods. Cultivating by hand or applying appropriate herbicide helps to control weeds and grasses.

If these soils are used as sites for septic tank absorption fields, fill material is needed to raise the absorption field a sufficient distance above the perched water table. The moderately slow permeability in the Josburg soil is an additional limitation. It can generally be overcome by increasing the size of the absorption field. The sides of shallow excavations can cave in unless they are shored in areas of both soils. Dwellings with basements should be built on raised, well compacted fill material, which helps to overcome the wetness. The foundations of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Constructing local roads in areas of the Dunn soil on suitable, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by wetness. The road damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage. Roads in areas of the Josburg soil should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

The land capability units are VIe-6, dryland, and IVe-10, irrigated. The Dunn soil is in the Sandy Lowland range site and windbreak suitability group 7. The Josburg soil is in the Sandy range site and windbreak suitability group 5.

Eb—Els loamy sand, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil formed in sandy eolian and alluvial material in sandhill valleys. It is subject to rare flooding. Areas range from 5 to 150 acres in size.

Typically, the surface layer is dark grayish brown, very friable loamy sand about 7 inches thick. Below this is a transitional layer of pale brown, loose fine sand about 8 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is mottled below a depth of 15 inches. It is light brownish gray in the upper part and light gray in the lower part. In some places the surface layer is fine sand or loamy fine sand. In other places the surface soil is more than 10 inches thick.

Included with this soil in mapping are areas of Ipage, Tryon, and Valentine soils. Valentine and Ipage soils are higher on the landscape than the Els soil and are better drained. Tryon soils are lower on the landscape than the Els soil and are poorly drained or very poorly drained. Also included are some small areas that are affected by alkali. Included soils make up 5 to 15 percent of this unit.

Permeability is rapid in the Els soil, and the available water capacity is low. The organic matter content is moderately low. Runoff is slow. The water intake rate is very high. Depth to the seasonal high water table ranges from about 1.5 feet in wet years to about 3.0 feet in dry years.

Most of the acreage supports native grasses and is used as hayland or range. A small acreage is used as irrigated cropland.

If dry-farmed, this soil is poorly suited to cultivated crops. Soil blowing is a hazard. Small grain is better suited than other crops. The soil may be too wet for cultivation during the wettest periods. During dry periods, the water table subirrigates the soil. Growing winter wheat eliminates the need for working the soil in spring and helps to control soil blowing when the surface is dry. Keeping crop residue on the surface also helps to control soil blowing when the surface is dry. Alfalfa is unsuitable in low areas because of the high water table.

If irrigated, this soil is poorly suited to corn and introduced grasses. Alfalfa can grow but is generally short lived. The soil is too sandy for gravity irrigation. A

sprinkler system is the best method of irrigation. Frequent, light applications of water help to prevent the leaching of plant nutrients. Tiling generally is not needed, but wetness is a problem in low areas in some periods. Maintaining a cover of crop residue and planting close-growing crops help to control soil blowing. Applying barnyard manure increases the content of organic matter and improves fertility.

If this soil is used as range or hayland, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, and switchgrass. These species make up 85 percent or more of the total annual forage. Prairie cordgrass, sedges, and forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, little bluestem, indiangrass, switchgrass, and prairie cordgrass decrease in abundance and are replaced by sideoats grama, western wheatgrass, bluegrass, slender wheatgrass, green muhly, sedges, and rushes. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.7 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during wet periods helps to maintain or improve the range condition. This soil is generally the first to be overgrazed when it is in a pasture that includes better drained, sandy soils. Properly located fences, livestock water, and salting facilities result in a more uniform distribution of grazing.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous and healthy. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in spring, before the ground thaws.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can withstand occasional wetness. Establishing seedlings and cultivating between the tree rows can be difficult in wet years. Planting should be delayed until the soil dries out. Weeds and undesirable grasses can be controlled by cultivating between the tree rows with conventional equipment. Areas near trees can be rototilled. Annual cover crops can be grown between the tree rows.

This soil is poorly suited to septic tank absorption fields because of the wetness and a poor filtering capacity. Adding fill material can raise the absorption field a sufficient distance above the seasonal high water table. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. Shoring should be done during dry periods. Dwellings should be constructed on raised, well compacted fill material, which helps to overcome the wetness and prevent flood damage. Constructing local roads on suitable, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding and wetness. The damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVw-5, dryland, and IVw-11, irrigated; Subirrigated range site; windbreak suitability group 2S.

EfB—Els-Ipage complex, 0 to 3 percent slopes. These deep soils formed in sandy eolian and alluvial material in sandhill valleys. The nearly level, somewhat poorly drained Els soil is in swales and is subject to rare flooding. The very gently sloping, moderately well drained Ipage soil is on the slightly higher ridges. Areas of this unit range from 10 to more than 500 acres in size. They are 45 to 65 percent Els soil and 20 to 45 percent Ipage soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Els soil has a surface layer of dark gray, very friable loamy sand about 7 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is very pale brown in the upper part and light gray and mottled in the lower part. In places the surface layer is fine sand or loamy fine sand.

Typically, the Ipage soil has a surface layer of dark grayish brown, very friable fine sand about 3 inches thick. Below this is a transitional layer of grayish brown, loose fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand. It is mottled at a depth of about 32 inches. In some places the surface layer is loamy sand. In other places it is more than 10 inches thick.

Included with these soils in mapping are small areas of Marlake, Tryon, and Valentine soils. Marlake and Tryon soils are lower on the landscape than the Els and Ipage soils and have a higher seasonal water table. Valentine soils are higher on the landscape than the Els and Ipage soils and are excessively drained. Included soils make up 10 to 15 percent of this unit.

Permeability is rapid in the Els and Ipage soils, and the available water capacity is low. The organic matter content is moderately low in the Els soil and low in the Ipage soil. Runoff is slow on both soils. The water

intake rate is very high. Depth to the seasonal high water table in the Els soil ranges from about 1.5 feet in wet years to about 3.0 feet in dry years. Depth to the seasonal high water table in the Ipage soil ranges from about 3 feet in wet years to about 6 feet in dry years.

Most of the acreage supports native grasses and is used as range or hayland. The rest is used as irrigated cropland. These soils are suitable as range or hayland. They are unsuited to dryland crops because of the droughtiness and a hazard of soil blowing on the Ipage soil.

If irrigated, these soils are poorly suited to corn, alfalfa, small grain, and introduced grasses. They are too sandy for gravity irrigation, but they can be irrigated by sprinklers. Soil blowing is a severe hazard unless the surface is adequately protected. It can be controlled by planting winter cover crops and close-growing crops and by leaving crop residue on the surface. During spring, wetness in the Els soil may delay planting. Applying barnyard manure increases the content of organic matter and improves fertility.

In areas used as range or hayland, the climax vegetation on the Els soil is dominantly big bluestem, little bluestem, indiangrass, and switchgrass. These species make up 85 percent of the total annual forage on this soil. Prairie cordgrass and other annual and perennial grasses, sedges, and forbs make up the rest. The climax vegetation on the Ipage soil is dominantly sand bluestem, prairie sandreed, little bluestem, needleandthread, and switchgrass. These species make up about 75 percent of the total annual forage on this soil. Blue grama, indiangrass, prairie junegrass, bluegrass, sedges, and other annual and perennial grasses and forbs make up the rest.

If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance and are replaced by Kentucky bluegrass, slender wheatgrass, sideoats grama, green muhly, and various sedges and rushes on the Els soil. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, and forbs dominate the site. If the Ipage soil is subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance. Initially, they are replaced by blue grama, needleandthread, prairie sandreed, sand dropseed, sedges, and annual grasses and forbs. If overgrazing continues for many years, the plants lose vigor and blowouts can form. During dry years, soil blowing may be a problem in severely overgrazed areas of the Els soil.

If the range is in excellent condition, the suggested initial stocking rate is 1.7 animal unit months per acre on the Els soil and 1.0 animal unit month per acre on the Ipage soil. The proper stocking rate depends on the percentage of each soil in the pasture and on the range condition. Proper grazing use, timely deferment of grazing, and restricted use during wet periods help to maintain or improve the range condition. Because growth rates differ on the two soils, achieving a uniform distribution of grazing is difficult. The plants on the Els soil are usually grazed first and may be overgrazed before those on the Ipage soil have been fully grazed. Properly locating water and salting facilities can result in a more uniform distribution of grazing. Areas that formerly were cropland should be seeded to a suitable grass mixture if they are used as range.

A large acreage is used for native hay (fig. 8). Mowing should be regulated so that the grasses remain vigorous and healthy. The hay is of best quality when the grasses are cut early. It should be harvested only every other year on the Ipage soil. After the ground is frozen, livestock can graze the Els soil without damaging the meadow. They should be removed in spring, before the ground thaws.

These soils are suited to the trees and shrubs grown as farmstead and feedlot windbreaks, but they are generally not suited to those grown as field windbreaks. The species selected for planting on the Els soil should be those that can withstand occasional wetness. Establishing seedlings can be difficult during wet years. The site should be tilled and the trees planted after the soil dries out. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment. Because the Ipage soil is loose, trees should be planted in shallow furrows and the site should not be cultivated. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Young seedlings can be damaged by windblown sand. Supplemental water is needed during dry periods until the trees are established.

These soils are poorly suited to septic tank absorption fields because of the wetness and a poor filtering capacity. Adding fill material can raise the absorption field a sufficient distance above the seasonal high water table. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. All dwellings on the Els soil and dwellings with basements on the Ipage soil should be constructed on raised, well compacted fill material, which helps to overcome the wetness and prevent the damage caused by flooding on the Els soil. Constructing local roads on suitable, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding and wetness on the Els soil. The damage caused by frost action in both soils can be minimized by a good surface drainage system

Figure 8.—Typical landscape in the Els-Ipage complex, 0 to 3 percent slopes, used for native hay.

and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-12, irrigated. The Els soil is in the Subirrigated range site and windbreak suitability group 2S. The Ipage soil is in the Sandy Lowland range site and windbreak suitability group 7.

Fu—Fluvaquents, sandy. These deep, nearly level, very poorly drained soils formed in stratified sandy alluvium along perennial streams on bottom land. They are frequently flooded. Slopes are typically 0 to 2 percent. Areas range from 5 to more than 100 acres in size.

Typically, the surface is covered by a layer of decaying organic matter about 3 inches thick. The surface layer is stratified, light brownish gray, mottled, loose loamy fine sand about 2 inches thick. The underlying material to a depth of 60 inches or more is stratified gray to white, mottled fine sand and loamy fine sand. Strata of coarse sand to fine sandy loam are in the lower part. The texture and color of these soils and the thickness of the surface layer vary widely from one area to another.

Included with these soils in mapping are small areas of Almeria and Bolent soils. These included soils are higher on the landscape than the Fluvaquents and have a lower seasonal water table. They make up 5 to 10 percent of this unit.

Permeability is rapid in the Fluvaquents, and the available water capacity is low. The organic matter content is high. Runoff is very slow or ponded. The seasonal high water table is about 2 feet above the surface in wet years to about 1 foot below the surface in dry years. Water covers the surface for long periods in most years.

These soils provide good habitat for wetland wildlife. They are too wet for cultivated crops, hayland, and range.

The vegetation on these soils generally is not palatable to livestock. It is dominantly indigobush, willows, cattails, ferns, rushes, arrowhead, and other coarse, water-tolerant plants. It provides good nesting sites and cover for wildlife.

These soils are not suited to the trees and shrubs grown as windbreaks because of the wetness and the flooding. A few marginal areas can be used for water-tolerant trees and shrubs that enhance recreational areas and wildlife habitat. Hand planting or other special management is needed.

These soils are not suitable as sites for sanitary facilities or buildings because of the flooding and the wetness. A suitable alternative site should be selected. Constructing local roads on suitable, well compacted fill material above the level of ponding and flooding, providing adequate roadside ditches, and installing culverts help to prevent the damage caused by ponding and flooding.

The land capability unit is VIIIw-7, dryland; windbreak suitability group 10. No range site is assigned.

GfC—Gates very fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loess on uplands. In a few places it is hummocky. Areas range from 5 to 100 acres in size.

Typically, the surface layer is pale brown, very friable very fine sandy loam about 6 inches thick. Below this is a transitional layer of very pale brown, very friable very fine sandy loam about 12 inches thick. The underlying material to a depth of 60 inches or more is very pale brown very fine sandy loam. Lime is at a depth of about 32 inches. In some places the surface layer is fine sandy loam or silt loam. In other places, lime is at or near the surface or the soil is noncalcareous.

Included with this soil in mapping are small areas of Hersh, Sandose, and Valentine soils. Hersh and Valentine soils have more sand than the Gates soil. Hersh soils are in landscape positions similar to those of the Gates soil. Valentine soils are on dunes on the higher parts of the landscape. Sandose soils are sandy in the upper part. They are slightly higher on the landscape than the Gates soil. Included soils make up 10 to 15 percent of this unit.

Permeability is moderate in the Gates soil, and the available water capacity is high. The organic matter content is low. Runoff is medium. The water intake rate is moderate.

Much of the acreage is used as cropland. The rest supports native grasses and is used as range or hayland. Some areas that formerly were cropland have been reseeded to grass or allowed to reseed naturally.

If dry-farmed, this soil is suited to corn, sorghum, alfalfa, and small grain. Water erosion is a severe hazard in cultivated areas. Contour farming helps to control runoff and erosion. A system of conservation tillage that keeps crop residue on the surface helps to control erosion and conserves moisture. Applications of barnyard manure increase the content of organic matter and improve fertility.

If irrigated, this soil is suited to corn, sorghum, alfalfa, and introduced grasses. It is better suited to close-growing crops than to row crops. A sprinkler system is the best method of irrigation. Water erosion is the main hazard. Maintaining fertility and properly distributing irrigation water are management concerns. Farming on the contour and keeping a cover of crops or crop residue on the surface help to control erosion. The rate at which irrigation water is applied should not exceed the rate of water intake of the soil. Crop residue left on the surface increases the rate of water intake.

If this soil is used as range, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, sideoats grama, and switchgrass. These species make up 70 percent or more of the total annual forage. Blue grama, needleandthread, leadplant, and other annual and perennial grasses, sedges, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance and are replaced by blue grama, needleandthread, plains muhly, sand dropseed, tall dropseed, western wheatgrass, and annual grasses and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

In areas where gullies have formed as a result of severe water erosion, land shaping may be needed. Deferment of grazing after the areas have been shaped helps to restore plant vigor.

This soil is suited to the trees and shrubs grown as windbreaks. Survival rates are good for suitable species, and growth rates are fair. The main hazard is water erosion. Irrigation is needed during periods of low rainfall. Planting on the contour helps to control erosion. Cultivation between the tree rows with conventional equipment and timely and careful applications of appropriate herbicide help to control the weeds and grasses that compete with the trees for moisture.

This soil generally is suitable as a site for septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are shored. The damage to local roads caused by frost action can be

Figure 9.—Typical landscape in the Gates-Hersh complex, 20 to 60 percent slopes.

minimized by a good surface drainage system. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-9, dryland, and IIIe-6, irrigated; Silty range site; windbreak suitability group 3.

GhG—Gates-Hersh complex, 20 to 60 percent slopes. These deep, steep and very steep, excessively drained soils are on dissected uplands (fig. 9). The Gates soil formed in loess on the lower side slopes. The Hersh soil formed in sandy and loamy eolian material on the upper side slopes and on narrow ridges. Areas of this map unit range from 10 acres to more than 400 acres in size. They are 50 to 65 percent Gates soil and 25 to 40 percent Hersh soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Gates soil has a surface layer of grayish brown, very friable very fine sandy loam about 6 inches thick. Below this is a transitional layer of pale brown, very friable very fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is very pale brown very fine sandy loam. Lime is at a depth of about 15 inches. In some places the surface layer is fine sandy loam. In other places, lime is at the surface or the soil is noncalcareous. In a few areas loess material is exposed on escarpments along the drainageways.

Typically, the Hersh soil has a surface layer of grayish brown, very friable fine sandy loam about 10

inches thick. Below this is a transitional layer of light brownish gray, very friable fine sandy loam about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray loamy very fine sand. In some places the surface layer is very fine sandy loam. In other places the underlying material is loamy fine sand, fine sandy loam, or fine sand.

Included with these soils in mapping are small areas of Valentine soils. These included soils are on narrow ridgetops on the highest parts of the landscape and are sandy throughout. Also included are areas of stratified loamy and silty material on narrow bottom land and a few small areas that have a slope of less than 20 percent. Included soils make up 10 to 15 percent of this unit.

Permeability is moderate in the Gates soil and moderately rapid in the Hersh soil. The available water capacity is high in the Gates soil and moderate in the Hersh soil. The organic matter content is low in both soils. Runoff is very rapid.

Nearly all of the acreage supports native grasses and is used as range. These soils are not suitable as cropland because of the slope. Water erosion is a severe hazard unless the surface is protected by a cover of grass.

In areas used as range, the climax vegetation on the Gates soil is dominantly big bluestem, little bluestem, indiangrass, sideoats grama, and switchgrass. These species make up 70 percent or more of the total annual forage on this soil. Blue grama, needleandthread, leadplant, sedges, and other grasses and forbs make up the rest. The climax vegetation on the Hersh soil is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 80 percent or more of the total annual forage on this soil. Blue grama, switchgrass, and other grasses and forbs make up the rest.

If subject to continuous heavy grazing, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, annual grasses, and forbs. Western wheatgrass and plains muhly increase in abundance on the Gates soil, and prairie sandreed increases in abundance on the Hersh soil. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing and water erosion are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. The slope can hinder the movement of range animals from one area to another. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

These soils are not suited to the trees and shrubs grown as windbreaks because of the slope. In places trees and shrubs used for wildlife habitat or for forestation can be established. Hand planting or other special management is needed.

These soils generally are not suitable as sites for sanitary facilities or buildings because of the slope. A suitable alternate site should be selected. Cutting and filling can provide a suitable grade for local roads.

The land capability unit is VIIe-3, dryland; windbreak suitability group 10. The Gates soil is in the Silty range site, and the Hersh soil is in the Sandy range site.

HeC—Hersh loamy fine sand, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in sandy and loamy eolian material on side slopes in the uplands. Areas range from 10 to more than 80 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 6 inches thick. The subsurface layer is light brownish gray, very friable loamy fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sandy loam and loamy very fine sand. In some places the dark surface soil is more than 6 inches thick. In other places the surface layer is very fine sandy loam, fine sandy loam, or fine sand.

Included with this soil in mapping are small areas of Gates and Valentine soils. Gates soils are in landscape positions similar to those of the Hersh soil and are finer textured. Valentine soils are higher on the landscape than the Hersh soil and are sandy throughout. Included soils make up 10 to 15 percent of this unit.

Permeability is moderately rapid in the Hersh soil, and the available water capacity is moderate. The organic matter content is low. Runoff is medium. This soil can be easily tilled. The water intake rate is high.

Much of the acreage is used for cultivated crops. The rest supports native grasses and is used as range or hayland. Some small areas that formerly were cropland have been reseeded to grass.

If dry-farmed, this soil is poorly suited to corn, alfalfa, small grain, and sorghum. The droughtiness is a management concern. Soil blowing is a serious hazard. Erosion can be adequately controlled and moisture conserved by tillage practices that maintain maximum amounts of crop residue on the surface after planting. A cropping system that includes legumes, grasses, or a mixture of both increases the content of organic matter and helps to maintain fertility. Row crops can be alternated with small grain and legumes.

If irrigated, this soil is poorly suited to corn, alfalfa,

sorghum, and introduced grasses. A sprinkler system is the best method of irrigation. Careful management of water application rates helps to prevent the leaching of plant nutrients below the root zone. Returning crop residue to the soil and keeping tillage to a minimum help to control water erosion and soil blowing and help to maintain fertility. Cover crops or crop residue left on the surface in winter helps to control soil blowing and water erosion. Adding barnyard manure increases the content of organic matter and improves fertility.

If this soil is used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 80 percent or more of the total annual forage. Blue grama, switchgrass, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance. Initially, these species are replaced by needleandthread, prairie sandreed, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, Scribner panicum, sand dropseed, needleandthread, and weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and water erosion are serious hazards. The droughtiness and competition for moisture from grasses and weeds also are management concerns. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Planting trees on the contour helps to control water erosion. Irrigation is needed during dry periods. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of herbicide.

This soil generally is suitable as a site for septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are shored. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-5, dryland, and IVe-10, irrigated; Sandy range site; windbreak suitability group 5.

HfB—Hersh-Gates complex, 0 to 3 percent slopes. These deep, nearly level and very gently sloping, well drained soils are on uplands. The Hersh soil formed in sandy and loamy eolian material. The Gates soil formed in loess. Areas of this unit range from 5 to 200 acres in size. They are 50 to 65 percent Hersh soil and 15 to 35 percent Gates soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Hersh soil has a surface layer of dark grayish brown, very friable fine sandy loam about 5 inches thick. Below this is a transitional layer of light brownish gray, very friable fine sandy loam about 5 inches thick. The upper part of the underlying material is pale brown fine sandy loam. The lower part to a depth of 60 inches or more is very pale brown loamy very fine sand and loamy fine sand. In places the dark surface soil is more than 10 inches thick. In a few places it is very fine sandy loam. In some areas the surface layer is loamy fine sand. In other areas fine sand or silty material is below a depth of 40 inches.

Typically, the Gates soil has a surface layer of dark grayish brown, very friable very fine sandy loam about 5 inches thick. Below this is a transitional layer of brown, very friable very fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is silt loam. It is pale brown in the upper part and very pale brown and calcareous in the lower part. In some places the surface layer is fine sandy loam or loamy fine sand. In other places the underlying material is sandy. In some areas the soil is noncalcareous throughout.

Included with these soils in mapping are small areas of Sandose and Valentine soils. These included soils are higher on the landscape than the Hersh and Gates soils. Sandose soils are sandy in the upper part, and Valentine soils are sandy throughout. Included soils make up 10 to 15 percent of this unit.

Permeability is moderately rapid in the Hersh soil and moderate in the Gates soil. The available water capacity is moderate in the Hersh soil and high in the Gates soil. The organic matter content is low in both soils. Runoff is slow or medium. The water intake rate is moderately high.

About half of the acreage of this unit is used as cropland. The rest supports native grasses and is used as range or hayland. Many areas that formerly were cropland have been reseeded to grass or allowed to reseed naturally.

If dry-farmed, these soils are suited to corn, sorghum, small grain, and alfalfa. The main management concerns are conserving soil moisture, improving fertility, and increasing the content of organic matter. A cropping system that maintains a cover of

crops or crop residue helps to control soil blowing and conserve moisture. A cropping system that includes legumes, grasses, or a mixture of both increases the content of organic matter, helps to maintain fertility, and helps to control soil blowing.

If irrigated, these soils are suited to corn, alfalfa, sorghum, and introduced grasses. They are suited to both gravity and sprinkler irrigation systems, but some land shaping generally is needed if a gravity system is used. Deep cuts may expose the sandy underlying material of the Hersh soil and should be avoided during land leveling. The rate of water application should be adjusted to the rate of water intake of these soils. If sprinklers are used, light, frequent applications of water help to prevent the excessive leaching of plant nutrients in the Hersh soil and help to ensure a uniform rate of water intake in both soils. Returning crop residue to the soil and applying a system of conservation tillage, such as no-till or till-plant, help to control soil blowing and improve fertility. Adding barnyard manure and planting green manure crops increase the content of organic matter and improve fertility.

In areas used as range or hayland, the climax vegetation on the Hersh soil is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up about 80 percent of the total annual forage on this soil. Blue grama, switchgrass, and other grasses and forbs make up the rest. The climax vegetation on the Gates soil is dominantly big bluestem, little bluestem, indiangrass, switchgrass, and sideoats grama. These species make up 70 percent or more of the total annual forage on this soil. Blue grama, needleandthread, leadplant, sedges, and other grasses and forbs make up the rest.

If subject to continuous heavy grazing, sand bluestem, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance and are replaced by blue grama, needleandthread, prairie sandreed, sand dropseed, tall dropseed, plains muhly, sedges, and annual grasses and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

These soils are well suited to the trees and shrubs grown as windbreaks. A low moisture supply, soil blowing on the adjacent soils, and competition from weeds and grasses are the main problems in establishing trees. Soil blowing can be controlled by maintaining strips of sod or a cover crop between the tree rows. Cultivation generally should be restricted to the tree rows. Irrigation is needed during dry periods. Weeds and grasses can be controlled by timely applications of appropriate herbicide.

These soils generally are suitable as sites for septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are shored. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIe-8, irrigated. The Hersh soil is in the Sandy range site and windbreak suitability group 5. The Gates soil is in the Silty range site and windbreak suitability group 3.

IfB—Ipage fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, moderately well drained soil formed in sandy eolian and alluvial material in sandhill valleys. Areas range from 5 to more than 500 acres in size.

Typically, the surface layer is grayish brown, loose fine sand about 6 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 9 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. It is mottled below a depth of 34 inches. In places the surface layer is sand or loamy fine sand. In a few places loamy material is below a depth of 40 inches.

Included with this soil in mapping are small areas of Els, Tryon, and Valentine soils. Els and Tryon soils are lower on the landscape than the Ipage soil. Els soils are somewhat poorly drained, and Tryon soils are poorly drained. Valentine soils are higher on the landscape than the Ipage soil and are excessively drained. Included areas make up 10 to 15 percent of this unit.

Permeability is rapid in the Ipage soil, and the available water capacity is low. The organic matter content also is low. Runoff is slow. The water intake rate is very high. Depth to the seasonal high water table ranges from about 3 feet in wet years to about 6 feet in dry years.

Nearly all of the acreage supports native grasses and is used as range or hayland. A few areas are used as irrigated cropland. This soil is unsuited to dryland crops because of the droughtiness and a hazard of soil blowing.

If irrigated, this soil is poorly suited to corn, alfalfa, and introduced grasses. It is too sandy for gravity

irrigation. A sprinkler system is the best method of irrigation. Frequent, light applications of water help to prevent the leaching of plant nutrients. Returning crop residue to the soil and applying barnyard manure increase the content of organic matter and improve fertility. Crop residue left on the surface helps to control soil blowing.

If this soil is used as range or hayland, the climax vegetation is dominantly sand bluestem, prairie sandreed, little bluestem, needleandthread, and switchgrass. These species make up 75 percent or more of the total annual forage. Blue grama, indiangrass, sedges, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, indiangrass, little bluestem, and switchgrass decrease in abundance and are replaced by blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and weeds. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result soil blowing is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. This soil is generally the first to be overgrazed when it is in a pasture that includes Sands or Choppy Sands range sites. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks. Because the soil is loose, trees should be planted in shallow furrows and the site should not be cultivated. Young seedlings can be damaged by windblown sand. Strips of sod or cover crops between the tree rows help to control soil blowing. Irrigation is needed during periods of low rainfall.

If this soil is used for septic tank absorption fields, fill material is needed to raise the absorption field a sufficient distance above the water table. This soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. Dwellings with basements should be built on raised, well compacted fill material, which helps to overcome the wetness. The road damage caused by frost action can be minimized by a surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-12, irrigated; Sandy Lowland range site; windbreak suitability group 7.

IgB—Ipage loamy fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, moderately well drained soil formed in sandy eolian and alluvial material in sandhill valleys. Areas range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 6 inches thick. Below this is a transitional layer of pale brown, very friable loamy fine sand about 11 inches thick. The underlying material is fine sand. It is very pale brown in the upper part and light gray in the lower part. It is mottled below a depth of 38 inches. In some places the surface layer is fine sandy loam, loamy sand, or fine sand. In other places the underlying material has thin strata of loamy material.

Included with this soil in mapping are small areas of Els, Hersh, and Valentine soils. Els soils are somewhat poorly drained and are lower on the landscape than the Ipage soil. Hersh soils have less sand than the Ipage soil and are well drained. They are higher on the landscape than the Ipage soil. Valentine soils are higher on the landscape than the Ipage soil and are excessively drained. Included soils make up 10 to 15 percent of this unit.

Permeability is rapid in the Ipage soil, and the available water capacity is low. The organic matter content also is low. Runoff is slow. The water intake rate is very high. Depth to the seasonal high water table ranges from about 3.0 feet in wet years to about 6.0 feet in dry years.

Nearly all of the acreage supports native grasses and is used as range or hayland. Some of the acreage is used as cropland. Most of the cropland is irrigated.

If dry-farmed, this soil is poorly suited to cultivated crops. Small grain and alfalfa are commonly grown. Small grain and the first cutting of alfalfa are generally better suited than other crops because they grow and mature in spring, when the amount of rainfall is higher. Soil blowing is a serious hazard. Windblown sandy material can destroy young seedlings in early spring. A cropping system that maintains a cover of crops, crop residue, or grass helps to control soil blowing, conserves moisture, and maintains fertility and the content of organic matter.

If irrigated, this soil is suited to corn, alfalfa, and

introduced grasses. A sprinkler system is the best method of irrigation. Frequent, light applications of water are needed because of the low available water capacity. These applications help to prevent the excessive leaching of plant nutrients. Returning crop residue to the soil and adding barnyard manure increase the content of organic matter and improve fertility. Leaving crop residue on the surface helps to control soil blowing.

If this soil is used as range or hayland, the climax vegetation is dominantly sand bluestem, prairie sandreed, little bluestem, needleandthread, and switchgrass. These species make up 75 percent or more of the total annual forage. Blue grama, indiangrass, sedges, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, indiangrass, little bluestem, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks if soil blowing is controlled by maintaining strips of sod or other vegetation between the tree rows. The droughtiness and competition for moisture from grasses and weeds are problems. Irrigation is needed during dry periods. Cultivating by hand or applying appropriate herbicide helps to control weeds and undesirable grasses.

If this soil is used as a site for septic tank absorption fields, fill material is needed to raise the absorption field a sufficient distance above the water table. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. Dwellings with basements can be built on raised, well compacted fill material, which increases the depth to the seasonal high water table. The road damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-5, dryland, and IVe-11, irrigated; Sandy Lowland range site; windbreak suitability group 5.

IhB—Ipage sand, terrace, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, moderately well drained soil formed in sandy eolian and alluvial material on stream terraces. Areas range from 5 to more than 300 acres in size.

Typically, the surface layer is dark grayish brown, loose sand about 6 inches thick. Below this is a transitional layer of grayish brown, loose sand about 3 inches thick. The upper part of the underlying material is light gray sand. The lower part to a depth of 60 inches or more is white coarse sand. Mottles are below a depth of 38 inches. In places the surface layer is fine sand or loamy fine sand. In a few places loamy strata are below a depth of 40 inches.

Included with this soil in mapping are small areas of Simeon and Valentine soils. These included soils are higher on the landscape than the Ipage soil and are excessively drained. They make up 10 to 15 percent of this unit.

Permeability is rapid in the Ipage soil, and the available water capacity is low. The organic matter content is low. Runoff is slow. The water intake rate is very high. Depth to the seasonal high water table ranges from about 3.5 feet in wet years to about 6.0 feet in dry years. In most places the water table drops below a depth of 6 feet in summer.

Nearly all of the acreage supports native grasses and is used as range. A few areas are used as irrigated cropland. This soil is not suitable for dryland crops because of the droughtiness and a hazard of soil blowing.

If irrigated, this soil is poorly suited to corn, alfalfa, and introduced grasses. It is too sandy for gravity irrigation. A sprinkler system is the best method of irrigation. Frequent, light applications of water help to prevent the excessive leaching of plant nutrients. Returning crop residue to the soil and applying barnyard manure increase the content of organic matter and improve fertility. Crop residue left on the surface helps to control soil blowing.

If this soil is used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, little bluestem, switchgrass, and

needleandthread. These species make up 65 percent or more of the total annual forage. Blue grama, indiangrass, sedges, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, indiangrass, little bluestem, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, and numerous annual and perennial weeds dominate the site. Under these conditions, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts may form.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. This soil is generally the first to be overgrazed when it is in a pasture that includes Sands and Choppy Sands range sites. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks. Because the soil is loose, trees should be planted in shallow furrows and the site should not be cultivated. Young seedlings can be damaged by windblown sand. Strips of sod or cover crops between the tree rows help to control soil blowing. Competition from weeds and grasses can be controlled by mowing between the tree rows and by applying appropriate herbicide within the row.

If this soil is used as a site for septic tank absorption fields, fill material is needed to raise the absorption field a sufficient distance above the water table. The soil readily absorbs but does not adequately filter the effluent in septic tanks. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. Dwellings with basements can be constructed on raised, well compacted fill material, which increases the depth to the seasonal high water table. The damage to local roads caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-12, irrigated; Sandy range site; windbreak suitability group 7.

ImB—Ipage loamy fine sand, terrace, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, moderately well drained soil formed in sandy eolian and alluvial material on stream terraces. Areas range from 5 to more than 200 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 8 inches thick. Below this is a transitional layer of light brownish gray, very friable loamy fine sand about 6 inches thick. The underlying material is light brownish gray loamy sand in the upper part and light gray sand and coarse sand in the lower part. It is mottled at a depth of about 29 inches. In some places the surface layer is fine sandy loam, loamy sand, or fine sand. In other places loamy strata are below a depth of 40 inches.

Included with this soil in mapping are small areas of Simeon and Valentine soils. These included soils are higher on the landscape than the Ipage soil and are excessively drained. They make up 10 to 15 percent of this unit.

Permeability is rapid in the Ipage soil, and the available water capacity is low. The organic matter content also is low. Runoff is slow. The water intake rate is very high. Depth to the seasonal high water table ranges from about 3.5 feet in wet years to about 6.0 feet in dry years. In most areas the water table drops below a depth of 6 feet in summer.

Most of the acreage is used as cropland. A large acreage supports native grasses and is used as range or hayland.

If dry-farmed, this soil is poorly suited to cultivated crops. Small grain and alfalfa are commonly grown. Small grain and the first cutting of alfalfa are generally better suited than other crops because they grow and mature in spring, when the amount of rainfall is higher. Soil blowing is a serious hazard. Windblown sandy material can destroy young seedlings in early spring. A cropping system that maintains a cover of crops, crop residue, or grass helps to control soil blowing, conserves moisture, and maintains fertility and the content of organic matter.

If irrigated, this soil is suited to corn, alfalfa, and introduced grasses. A sprinkler system is the best method of irrigation. Frequent, light applications of water are needed because of the low available water capacity. These applications help to prevent the excessive leaching of plant nutrients. Returning crop residue to the soil and adding barnyard manure increase the content of organic matter and improve

fertility. Leaving crop residue on the surface helps to control soil blowing.

If this soil is used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, little bluestem, needleandthread, and switchgrass. These species make up 65 percent or more of the total annual forage. Blue grama, indiangrass, sedges, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, indiangrass, little bluestem, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range. It should not be mowed in the period between the boot stage and seed maturity. The proper mowing height helps to maintain the stand of grass and high forage production. It should be 3 or more inches.

This soil is suited to the trees and shrubs grown as windbreaks if soil blowing is controlled by maintaining strips of sod or other vegetation between the tree rows. The droughtiness and competition for moisture from grasses and weeds are problems. Irrigation is needed during dry periods. Cultivating by hand or applying appropriate herbicide helps to control weeds and undesirable grasses.

If this soil is used as a site for septic tank absorption fields, fill material is needed to raise the absorption field a sufficient distance above the water table. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. Dwellings with basements can be built on raised, well compacted fill material, which increases the depth to the seasonal high water table. The road damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-5, dryland, and IVe-11, irrigated; Sandy range site; windbreak suitability group 5.

ItB—Ipage-Tryon complex, 0 to 3 percent slopes. These deep soils formed in sandy eolian and alluvial material in sandhill valleys. The Ipage soil is very gently sloping and moderately well drained. It is on low ridges and knolls. The Tryon soil is nearly level and very poorly drained. It is in swales and is subject to rare flooding. Areas of this unit range from 10 to 500 acres in size. They are 50 to 65 percent Ipage soil and 25 to 45 percent Tryon soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Ipage soil has a surface layer of grayish brown, loose fine sand about 6 inches thick. Below this is a transitional layer of pale brown, loose fine sand about 13 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is very pale brown in the upper part and light brownish gray in the lower part. It is mottled at a depth of about 38 inches. In places the surface layer is loamy fine sand or loamy sand. In a few places the dark surface soil is more than 10 inches thick.

Typically, the Tryon soil has a surface layer of dark gray, very friable loamy fine sand about 5 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches is light brownish gray and light gray, mottled fine sand. In some places the surface layer is fine sandy loam or sandy loam. In other places the dark surface soil is more than 10 inches thick.

Included with these soils in mapping are small areas of Els, Marlake, and Valentine soils. Els soils are on the same landscape as the Tryon and Ipage soils. They are somewhat poorly drained. Marlake soils are in the lowest positions on the landscape and are ponded for long periods of time. Valentine soils are excessively drained and are higher on the landscape than the Ipage soil. Included soils make up 5 to 15 percent of this unit.

Permeability is rapid in the Ipage and Tryon soils, and the available water capacity is low. The organic matter content is low in the Ipage soil and high in the Tryon soil. Runoff is slow on the Ipage soil and very slow or ponded on the Tryon soil. Depth to the seasonal high water table in the Ipage soil ranges from about 3 feet in wet years to about 6 feet in dry years. The seasonal high water table in the Tryon soil is about 0.5 foot above the surface in wet years to about 1.0 foot

below the surface in dry years.

Most of the acreage supports native grasses and is used as range or hayland. These soils are not suitable as cropland because of the very high water table in the Tryon soil and a hazard of soil blowing on the Ipage soil. A small acreage that is bordered by soils better suited to crops is used as irrigated cropland.

In areas used as range or hayland, the climax vegetation on the Ipage soil is dominantly sand bluestem, prairie sandreed, little bluestem, needleandthread, and switchgrass. These species make up 75 percent or more of the total annual forage on this soil. Blue grama, indiangrass, sedges, and other grasses and forbs make up the rest. The climax vegetation on the Tryon soil is dominantly prairie cordgrass, northern reedgrass, bluejoint reedgrass, and various rushes. These species make up 65 percent or more of the total annual forage on this soil. Slender wheatgrass, sedges, and other grasses and forbs make up the rest.

If subject to continuous heavy grazing or improperly harvested for hay, bluejoint reedgrass, prairie cordgrass, and northern reedgrass decrease in abundance on the Tryon soil and sand bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance on the Ipage soil. They are replaced by slender wheatgrass, plains muhly, and various sedges on the Tryon soil and prairie sandreed, needleandthread, blue grama, sand dropseed, sedges, annual grasses, and forbs on the Ipage soil. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing may be excessive and small blowouts may form on the Ipage soil.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre on the Ipage soil and 2.1 animal unit months per acre on the Tryon soil. Stocking rates for a pasture in this unit vary considerably, depending on the percentage of each soil in the pasture and the condition of the range. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during very wet periods helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in more uniform distribution of grazing. Overgrazing and operating heavy machinery when the Tryon soil is wet cause surface compaction and the formation of small mounds and ruts, which make harvesting hay and grazing difficult.

If these soils are used as hayland, mowing should be regulated so that the grasses remain vigorous and healthy. The forage should be harvested only every other year on the Ipage soil. In wetter years, some areas of hay on the Tryon soil cannot be harvested. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in spring, before the ground thaws and the water table reaches a high level.

The Ipage soil is suited to the trees and shrubs grown as windbreaks. The Tryon soil generally is not suited because of the wetness. Establishing seedlings in wet years can be difficult. Because the Ipage soil is loose, trees should be planted in shallow furrows and the site should not be cultivated. Young seedlings can be damaged by windblown sand. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing. Irrigation can provide the needed moisture during periods of insufficient rainfall until the trees are established.

Onsite investigation is needed to determine the suitability of these soils for engineering uses. The Tryon soil is not suitable as a site for sanitary facilities or dwellings because of the wetness and the flooding. A suitable alternative site should be selected. The Ipage and Tryon soils do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. In areas of the Ipage soil, adding fill material can raise the absorption field a sufficient distance above the seasonal high water table. The sides of shallow excavations can cave in unless they are shored in areas of both soils. Dwellings with basements on the Ipage soil should be constructed on raised, well compacted fill material, which increases the depth to the seasonal high water table. Roads on the Tryon soil should be constructed on suitable, well compacted fill material. Providing adequate roadside ditches and installing culverts help to prevent the road damage caused by flooding and wetness. A good surface drainage system and a gravel moisture barrier in the subgrade minimize the damage caused by frost action in the Ipage soil. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage.

The land capability unit is VIe-5, dryland. The Ipage soil is in the Sandy Lowland range site and windbreak suitability group 7. The Tryon soil is in the Wetland range site and windbreak suitability group 10.

JnB—Jansen loamy fine sand, 0 to 3 percent slopes. This level and very gently sloping, well drained soil formed in sandy and loamy material on stream terraces. It is moderately deep over gravelly coarse sand. Areas range from 80 to 140 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 6 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 10 inches thick. The subsoil is about

18 inches thick. It is brown, friable loam in the upper part; very pale brown, friable loam in the next part; and light gray, very friable fine sandy loam in the lower part. The upper part of the underlying material is very pale brown fine sandy loam. The lower part to a depth of 60 inches is white gravelly coarse sand. In some places the surface layer is fine sandy loam. In other places the surface soil is more than 20 inches thick.

Included with this soil in mapping are small areas of Sandose and Vetal soils. Sandose soils are sandy in the upper part and are higher on the landscape than the Jansen soil. Vetal soils have less clay in the subsoil than the Jansen soil and are in similar landscape positions. Included soils make up 10 to 15 percent of this unit.

Permeability in the Jansen soil is moderate in the solum and rapid or very rapid in the underlying material. The available water capacity is moderate. The organic matter content is moderately low. Runoff is slow. The water intake rate is high. This soil can be easily tilled. It absorbs water easily and releases the water readily to plants.

Almost all of the acreage is used as irrigated cropland.

If dry-farmed, this soil is suited to corn, alfalfa, small grain, and sorghum. Insufficient seasonal rainfall limits crop production in most years. Tillage practices that maintain maximum amounts of crop residue on the surface help to control soil blowing, conserve moisture, and improve tilth. A cropping system which includes legumes, grasses, or a mixture of both increases the content of organic matter and helps to maintain fertility. Returning crop residue to the soil and adding barnyard manure increase the content of organic matter and improve fertility.

If irrigated, this soil is suited to corn, alfalfa, sorghum, small grain, and introduced grasses. A sprinkler system is the best method of irrigation. Water application rates should be carefully managed to avoid the leaching of plant nutrients below the root zone. Returning crop residue to the soil and keeping tillage to a minimum help to control erosion and maintain fertility. Cover crops or crop residue left on the surface helps to control soil blowing. Adding barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying depletes the protective cover of native plants. Overgrazing also can result in severe soil blowing and the formation of small blowouts. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing is a hazard. It can be controlled by maintaining strips of sod or other vegetation between the tree rows. The droughtiness and competition for moisture from grasses and weeds are management concerns. Irrigation is needed during dry periods. Cultivation with conventional equipment and timely applications of appropriate herbicide help to control weeds and undesirable grasses.

This soil generally is suitable as a site for septic tank absorption fields. The foundations of buildings without basements can be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-6, dryland, and IIIe-10, irrigated; Sandy range site; windbreak suitability group 6G.

JrB—Josburg-Dunn loamy fine sands, 0 to 3 percent slopes. These deep, nearly level and very gently sloping, moderately well drained soils are on uplands. The Josburg soil formed in loamy sediments, and the Dunn soil formed in sandy eolian material overlying loamy sediments. These soils are in similar positions on the landscape. Areas range from 10 to 300 acres in size. They are 55 to 70 percent Josburg soil and 20 to 35 percent Dunn soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Josburg soil has a surface layer of grayish brown, very friable loamy fine sand about 7 inches thick. The subsoil is light brownish gray, firm loam about 11 inches thick. The underlying material to a depth of 60 inches or more is fine sandy loam. It is light gray in the upper part and white in the lower part. In places the surface layer is fine sandy loam or loam.

Typically, the Dunn soil has a surface layer of grayish brown, very friable loamy fine sand about 5 inches thick. The subsurface layer is similar in color and texture to the surface layer and is about 9 inches thick. The underlying material is light gray, mottled, loose fine sand about 10 inches thick. The next 14 inches is light brownish gray, firm loam. Below this to a depth of 60 inches or more is light gray loam. In places the surface layer is fine sandy loam or loamy sand. In a few places sandy material is below a depth of 40 inches.

Included with these soils in mapping are small areas of Hersh, Ipage, and Valentine soils. Hersh soils have less clay throughout than the Josburg and Dunn soils and are well drained. Ipage soils are sandy throughout and are in the lower positions on the landscape.

Valentine soils are excessively drained and are sandy. They are higher on the landscape than the Dunn and Josburg soils. Included soils make up 10 to 15 percent of this unit.

Permeability is moderately slow in the Josburg soil. It is rapid in the upper part of the Dunn soil and moderately slow in the lower part. The available water capacity is moderate in both soils. The organic matter content is moderately low. Runoff is slow. The water intake rate is high. Depth to the seasonal high water table ranges from about 3 feet in wet years to about 6 feet in dry years.

Most of the acreage supports native grasses and is used as range or hayland. The rest is used mainly as irrigated cropland.

If dry-farmed, these soils are suited to corn, small grain, and alfalfa. Insufficient rainfall is the main problem. Small grain and the first cutting of alfalfa are generally better suited than other crops because they grow and mature in spring when the amount of rainfall is higher. Soil blowing is a serious hazard. Windblown sandy material can destroy young seedlings in early spring. A cropping system that maintains a cover of crops, crop residue, or grass helps to control soil blowing, conserves moisture, and maintains fertility and the content of organic matter.

If irrigated, this unit is suited to corn, alfalfa, and introduced grasses. A sprinkler system is the best method of irrigation. Frequent, light applications of water help to prevent the excessive leaching of plant nutrients. Returning crop residue to the soil and adding barnyard manure increase the content of organic matter and improve fertility. Leaving crop residue on the surface helps to control soil blowing.

In areas used as range or hayland, the climax vegetation on the Josburg soil is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage on this soil. Blue grama, sedges, and other grasses and forbs make up the rest. The climax vegetation on the Dunn soil is dominantly big bluestem, needleandthread, little bluestem, prairie sandreed, and switchgrass. These species make up 60 percent of the total annual forage on this soil. Purple lovegrass, blue grama, Kentucky bluegrass, prairie junegrass, indiangrass, sedges, and other grasses and forbs make up the rest.

If subject to continuous heavy grazing, big bluestem, little bluestem, indiangrass, sand bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, prairie sandreed, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and numerous annual and perennial weeds invade the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre on the Josburg soil and 1.0 animal unit month per acre on the Dunn soil. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If these soils are used as hayland, mowing should be regulated so that the grasses remain vigorous and healthy. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

These soils are suited to the trees and shrubs grown as windbreaks if soil blowing is controlled by maintaining strips of sod or other vegetation between the tree rows. The droughtiness and competition for moisture from grasses and weeds are problems. Irrigation is needed during dry periods. Cultivating by hand or applying appropriate herbicide helps to control weeds and undesirable grasses.

If these soils are used as sites for septic tank absorption fields, fill material is needed to raise the absorption field a sufficient distance above the water table. The moderately slow permeability in the Josburg soil is an additional limitation. It can generally be overcome by increasing the size of the field. The sides of shallow excavations in areas of the Dunn soil can cave in unless they are shored. Dwellings on both soils should be constructed on raised, well compacted fill material, which helps to overcome the wetness. The foundations of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on the Josburg soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance. Constructing local roads on the Dunn soil on suitable, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by wetness. The damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and providing adequate roadside ditches help to provide the needed surface drainage on both soils.

The land capability units are IIIe-5, dryland, and IIIe-10, irrigated; windbreak suitability group 5. The

Josburg soil is in the Sandy range site, and the Dunn soil is in the Sandy Lowland range site.

Ma—Marlake loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, very poorly drained soil formed in sandy alluvium in depressions in sandhill valleys and in low areas bordering lakes. It has a very high water table and is frequently ponded. Areas range from 5 to 80 acres in size.

Typically, the surface layer is dark gray, stratified, very friable loamy fine sand about 6 inches thick. Below this is a transitional layer of grayish brown, mottled, stratified, loose fine sand about 5 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled, stratified fine sand. In places the surface layer is fine sandy loam or loam.

Included with this soil in mapping are small areas of Tryon soils. These included soils have a lower seasonal water table than the Marlake soil and are higher on the landscape. Also included are a few small lakes and a few small areas that are affected by alkali. Included soils make up 5 to 10 percent of this unit.

Permeability is rapid in the Marlake soil, and the available water capacity is low. The organic matter content is high. Runoff is ponded. The seasonal high water table is about 2 feet above the surface in wet years to about 1 foot below the surface in dry years. Water covers the surface for long periods of time in most years.

This soil provides good habitat for wildlife. It is too wet for use as cultivated cropland, hayland, or range. The vegetation is coarse and not palatable to livestock. It is dominantly cattails, rushes, arrowhead, and other water-tolerant plants. The excessive wetness of the soil prevents mowing except in extremely dry years.

This soil provides excellent habitat for wetland wildlife (fig. 10). The cattails and rushes are good cover for waterfowl and shore birds. Ducks, geese, and herons are common throughout areas of this soil. Muskrats are common in the larger areas. Blackbirds, ducks, and killdeer nest in or near areas of this soil.

This soil is unsuited to the trees and shrubs grown as windbreaks because of the very high water table. Trees and shrubs for recreational areas or wildlife habitat or for forestation can be established in a few areas if suitable species are hand planted or other special management is applied.

This soil is not suitable as a site for septic tank absorption fields or buildings because of the ponding. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. They should be shored during dry periods. Constructing local roads on suitable, well compacted fill material above the level of ponding, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by ponding.

The land capability unit is VIIIw-7, dryland; windbreak suitability group 10. No range site is assigned.

MeF—Meadin loamy sand, 3 to 30 percent slopes. This gently sloping to steep, excessively drained soil is on terrace breaks along the North Loup River. It formed in sandy material that is shallow over gravelly coarse sand. Areas range from 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown, very friable loamy sand about 4 inches thick. Below this is a transitional layer of brown, loose coarse sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light yellowish brown and very pale brown gravelly coarse sand. In places the surface layer is loam, sandy loam, or sand.

Included with this soil in mapping are small areas of Simeon and Valentine soils. Simeon soils do not have gravelly coarse sand, and Valentine soils do not have coarse sand or gravelly coarse sand. Simeon soils are in landscape positions similar to those of the Meadin soil, and Valentine soils are higher on the landscape. Included soils make up less than 15 percent of this unit.

Permeability is rapid in the upper part of the Meadin soil and very rapid in the lower part. The available water capacity is very low. The organic matter content is moderately low. Runoff is slow. Because the surface layer is very friable, moisture is readily absorbed but much of it is lost through deep percolation.

Most of the acreage supports native grasses and is used as range. This soil is not suitable as cropland because of the slope. Areas that formerly were cropland should be reseeded to grass.

If this soil is used as range, the climax vegetation is dominantly blue grama, needleandthread, clubmoss, prairie sandreed, sand bluestem, and fringed sagebrush. These species make up 80 percent or more of the total annual forage. Sand dropseed, hairy grama, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem and prairie sandreed decrease in abundance and are replaced by hairy grama, blue grama, sand dropseed, needleandthread, sedges, annual grasses, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, clubmoss, common pricklypear, brittle pricklypear, small soapweed, fringed sagewort, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned, short period

Figure 10.—An area of Marlake loamy fine sand, 0 to 2 percent slopes, that provides excellent food and cover for wetland wildlife.

of heavy grazing during the grazing season or deferment of grazing in 2 out of 3 years helps to retain little bluestem and prairie sandreed in the plant community. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

This soil is poorly suited to the trees and shrubs grown as windbreaks and to plantings that enhance recreational areas and wildlife habitat. The slope and the droughtiness are the main limitations. Special management, such as hand planting, is needed. Because of the very low available water capacity, additional water should be applied during periods of insufficient rainfall.

This soil generally is unsuitable as a site for sanitary facilities because of the slope and a poor filtering capacity. The poor filtering capacity can result in the pollution of ground water. A suitable alternative site should be selected. Because of the slope, excavating is difficult. The sides of shallow excavations can cave in unless they are shored. In areas where the slope is less than 8 percent, the soil generally is suitable as a site for dwellings and local roads. In areas where the slope is more than 8 percent, the dwellings and roads should be designed so that they conform to the natural slope of the land. Building sites can be graded to a suitable gradient, and cutting and filling can provide a suitable grade for roads.

The land capability unit is VIs-4, dryland; Shallow to Gravel range site; windbreak suitability group 10.

SdB—Sandose loamy fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on stream terraces and uplands. It formed in sandy eolian material overlying loamy material. Areas range from 5 to more than 300 acres in size.

Typically, the surface layer is dark brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is grayish brown, very friable loamy fine sand about 6 inches thick. The subsoil is 25 inches thick. It is brown, loose fine sand in the upper part; dark grayish brown, very friable very fine sandy loam in the next part; and grayish brown, very friable very fine sandy loam in the lower part. The underlying material to a depth of 60 inches or more is light brownish gray very

fine sandy loam. In places sandy material is below a depth of 40 inches. In a few places the surface layer is sand, fine sand, fine sandy loam, or sandy loam.

Included with this soil in mapping are small areas of Valentine soils. These included soils are higher on the landscape than the Sandose soil and are sandy throughout. They make up 5 to 15 percent of this unit.

Permeability is rapid in the sandy upper part of the Sandose soil and moderate in the loamy lower part. The available water capacity is moderate. The organic matter content is moderately low. Runoff is slow. The water intake rate is high. This soil can be easily tilled throughout a wide range in moisture content.

Most of the acreage supports native grasses and is used as range. Some areas are used as cropland.

If dry-farmed, this soil is poorly suited to corn, alfalfa, sorghum, and small grain. Insufficient seasonal rainfall limits crop production in most years. Soil blowing is a serious hazard. Conservation tillage, stripcropping, and a cropping system that maintains a cover of crops or crop residue helps to control soil blowing and conserve moisture. A cropping system that includes legumes, grasses, or a mixture of both increases the content of organic matter, helps to maintain fertility, and helps to control soil blowing. Row crops can be alternated with small grain and legumes.

If irrigated, this soil is suited to corn, alfalfa, sorghum, and introduced grasses. A sprinkler system is the best method of irrigation. Light, frequent applications of water help to prevent the leaching of plant nutrients below the root zone. Returning crop residue to the soil and conservation tillage practices that keep tillage to a minimum help to control erosion and improve fertility. Cover crops or crop residue left on the surface helps to control soil blowing in winter. Adding barnyard manure to the soil increases the content of organic matter and improves fertility.

If this soil is used as range, the climax vegetation is dominantly little bluestem, prairie sandreed, needleandthread, and blue grama. These species make up 65 percent of the total annual forage. Sand bluestem, sedges, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is about 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks if soil blowing is controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide supplemental moisture during dry periods. Cultivation or applications of appropriate herbicide help to control weeds and undesirable grasses.

This soil is suitable as a site for buildings and local roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored.

The land capability units are IIIe-6, dryland, and IIIe-10, irrigated; Sandy range site; windbreak suitability group 5.

SmB—Simeon sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, excessively drained soil formed in sandy alluvium on stream terraces. Areas range from 10 to 1,000 acres in size.

Typically, the surface layer is grayish brown, loose sand about 5 inches thick. Below this is a transitional layer of light brownish gray, loose sand about 9 inches thick. The underlying material to a depth of 60 inches or more is very pale brown and white coarse sand. In some places the surface layer is loamy fine sand or loamy sand. In other places the surface soil is more than 10 inches thick.

Included with this soil in mapping are small areas of Ipage, Sandose, and Valentine soils. Ipage soils are moderately well drained and are lower on the landscape than the Simeon soil. Ipage and Valentine soils have fine sand in the underlying material. Sandose and Valentine soils are higher on the landscape than the Simeon soil. Sandose soils have loamy underlying material. Included soils make up 5 to 15 percent of this unit.

Permeability is rapid in the Simeon soil, and the available water capacity is low. The organic matter content also is low. Runoff is very slow. The water intake rate is very high. Moisture is released readily to plants, but much of it is lost through deep percolation.

Most of the acreage supports native grasses and is used as range. A small acreage is used as irrigated cropland. This soil is not suitable for dryland crops because of the droughtiness and a hazard of soil blowing.

If irrigated, this soil is poorly suited to corn, sorghum, and alfalfa. It is not suited to gravity irrigation because of the very high rate of water intake. A sprinkler system is the best method of irrigation. Frequent, light applications of water help to prevent the leaching of plant nutrients. Soil blowing is a serious hazard if the surface is not protected by crops or crop residue. Close-growing crops and a system of conservation tillage that keeps crop residue on the surface help to control soil blowing and conserve moisture. Adding barnyard manure improves fertility and increases the content of organic matter.

A cover of range plants is very effective in controlling soil blowing on this soil. The low available water capacity is a limitation. The amount of forage produced varies, depending on the frequency and amount of seasonal rainfall. Areas previously used as cropland should be reseeded to a suitable grass mixture.

If this soil is used as range, the climax vegetation is dominantly blue grama, hairy grama, needleandthread, prairie sandreed, sand bluestem, and little bluestem. These species make up 75 percent or more of the total annual forage. Sand dropseed, clubmoss, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and prairie sandreed decrease in abundance and are replaced by hairy grama, blue grama, sand dropseed, needleandthread, sedges, annual grasses, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, clubmoss, common pricklypear, brittle pricklypear, fringed sagewort, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is about 0.6 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned, short period of heavy grazing during the grazing season or deferment of grazing in 2 out of 3 years helps to retain little bluestem and prairie sandreed in the plant community. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

This soil is generally unsuited to the trees or shrubs grown as windbreaks and to plantings that enhance recreational areas or wildlife habitat. Onsite investigation is needed to identify areas where trees and shrubs can be grown. Special management is needed in these areas.

This soil is suitable as a site for dwellings and local roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored.

The land capability units are VIs-4, dryland, and IVs-14, irrigated; Shallow to Gravel range site; windbreak suitability group 10.

SmF—Simeon sand, 3 to 30 percent slopes. This deep, gently sloping to steep, excessively drained soil formed in sandy alluvium on terrace breaks along the North Loup River. Areas range from 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, loose sand about 4 inches thick. Below this is a transitional layer of brown, loose sand about 9 inches thick. The upper part of the underlying material is pale brown sand. The lower part to a depth of 60 inches or more is white coarse sand. In some places the surface layer is loamy sand or sandy loam. In other places the underlying material is gravelly coarse sand.

Included with this soil in mapping are small areas of Sandose and Valentine soils. These included soils do not have coarse sand in the underlying material and are higher on the landscape than the Simeon soil. They make up 5 to 15 percent of this unit.

Permeability is rapid in the Simeon soil, and the available water capacity is low. The organic matter content also is low. Runoff is slow. Moisture is readily absorbed by this soil, but much of it is lost through deep percolation.

Most of the acreage supports native grasses and is used as range. This soil is not suitable as cropland because of the slope. Areas that formerly were cropland should be reseeded to grass.

If this soil is used as range, the climax vegetation is dominantly blue grama, needleandthread, prairie sandreed, sand bluestem, and little bluestem. These species make up 70 percent or more of the total annual forage. Sand dropseed, hairy grama, clubmoss, fringed sagebrush, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and prairie sandreed decrease in abundance and are replaced by hairy grama, blue grama, sand dropseed, needleandthread, sedges, annual grasses, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, clubmoss, common pricklypear, brittle pricklypear, fringed sagewort, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned, short period of heavy grazing during the grazing season or

deferment of grazing in 2 out of 3 years helps to keep little bluestem and prairie sandreed in the plant community. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

This soil generally is poorly suited to the trees and shrubs grown as windbreaks and to plantings that enhance recreational areas and wildlife habitat. The slope and the sandy surface layer are the main limitations. Special management, such as hand planting, is needed. Because of the low available water capacity, additional water should be applied during periods of insufficient rainfall.

This soil generally is not suitable as a site for sanitary facilities because of the slope and a poor filtering capacity. The poor filtering capacity can result in the pollution of ground water. A suitable alternative site should be selected. Because of the slope, excavating is difficult. The sides of shallow excavations can cave in unless they are shored. In areas where the slope is less than 8 percent, the soil generally is suitable as a site for dwellings and local roads. In areas where the slope is more than 8 percent, the dwellings and roads should be designed so that they conform to the natural slope of the land. Building sites can be graded to a suitable gradient, and cutting and filling can provide a suitable grade for roads.

The land capability unit is VIs-4, dryland; Shallow to Gravel range site; windbreak suitability group 10.

To—Tryon loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, poorly drained soil formed in sandy eolian and alluvial material in sandhill valleys. It is subject to rare flooding. Areas range from 10 to 200 acres in size.

Typically, the surface layer is very dark gray, very friable loamy fine sand about 5 inches thick. Below this is a transitional layer of gray, mottled, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand. Water may cover the surface in some of the low areas and drainageways for a few days in spring and in other wet periods.

Included with this soil in mapping are small areas of Els and Marlake soils. Els soils are higher on the landscape than the Tryon soil and are somewhat poorly drained. Marlake soils are lower on the landscape than the Tryon soil and are wet for longer periods of time. Also included are small areas that are affected by alkali. Included soils make up 10 to 15 percent of this unit.

Permeability is rapid in the Tryon soil, and the available water capacity is low. The organic matter content is high. Runoff is very slow. The seasonal high water table is at the surface in wet years to a depth of 1.5 feet in dry years. It normally drops to a depth of 2 to 4 feet in late summer.

Nearly all of the acreage supports native grasses and is used as range or hayland (fig. 11). This soil is too wet for use as cropland.

If this soil is used as range, the climax vegetation is dominantly switchgrass, indiangrass, big bluestem, and prairie cordgrass. These species make up 60 percent or more of the total annual forage. Bluegrass, reedgrass, slender wheatgrass, sedges, rushes, and other grasses and forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, prairie cordgrass, switchgrass, reedgrass, and indiangrass decrease in abundance and are replaced by slender wheatgrass, western wheatgrass, green muhly, rushes, and sedges. Timothy, redtop, and clover also increase in abundance if they have been overseeded. If overgrazing or improper haying continues for many years, bluegrass, western wheatgrass, foxtail barley, and various sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.9 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use in very wet periods helps to maintain or improve the range condition. This soil is generally the first to be overgrazed when it is in a pasture that includes better drained, sandy soils. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Overgrazing and operating heavy machinery when the soil is wet cause surface compaction and the formation of small mounds and ruts, which make harvesting hay and grazing difficult.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. Large meadows can be divided into three sections and the sections mowed in rotation. The order in which the sections are mowed should be changed in successive years. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in spring, before the ground thaws and the water table reaches a high level.

This soil is suited to the water-tolerant trees and shrubs grown as windbreaks. Wetness from the high water table is the main limitation. Site preparation and planting in spring may not be possible until the water table drops and the soil is sufficiently dry. Weeds and undesirable grasses that compete with the trees can be controlled by cultivating between the tree rows when the water table is at its lowest level.

This soil is not suitable as a site for sanitary facilities or dwellings because of the wetness. A suitable

Figure 11.—An area of Tryon loamy fine sand, 0 to 2 percent slopes, that supports a heavy growth of native grasses. Areas of this soil can be used as range or hayland.

alternative site should be selected. This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. They should be shored during dry periods. Constructing local roads on suitable, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by wetness.

The land capability unit is Vw-7, dryland; Wet Subirrigated range site; windbreak suitability group 2D.

Tp—Tryon loamy fine sand, wet, 0 to 2 percent slopes. This deep, nearly level, very poorly drained soil formed in sandy eolian and alluvial material in sandhill valleys. It has a high water table. It is subject to rare flooding and commonly is ponded in spring and in other wet periods. Areas range from 5 to 100 acres in size.

Typically, the surface layer is dark gray, very friable loamy fine sand about 5 inches thick. Below this is a transitional layer of grayish brown, mottled, very friable loamy sand about 6 inches thick. The underlying material to a depth of more than 60 inches is mottled and light gray. It is fine sand in the upper part, loamy sand in the next part, and fine sand in the lower part. In some places the surface layer is fine sand or fine sandy loam. In other places the surface soil is more than 10 inches thick.

Included with this soil in mapping are small areas of Els and Marlake soils. Els soils are higher on the landscape than the Tryon soil and are somewhat poorly drained. Marlake soils are lower on the landscape than the Tryon soil and are wet for longer periods of time. Also included are small areas that are affected by alkali. Included soils make up 5 to 10 percent of this unit.

Permeability is rapid in the Tryon soil, and the available water capacity is low. The organic matter content is high. Runoff is very slow or ponded. The seasonal high water table is about 0.5 foot above the

surface in wet years to about 1.0 foot below the surface in dry years. It normally drops to a depth of about 1 to 2 feet by late summer.

Most of the acreage supports native grasses and is used as range or hayland. This soil is too wet for use as cropland.

If this soil is used as range or hayland, the climax vegetation is dominantly prairie cordgrass, bluejoint reedgrass, and northern reedgrass. These species make up 60 percent or more the total annual forage. Slender wheatgrass, sedges, rushes, and other grasses and forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, prairie cordgrass, bluejoint reedgrass, and northern reedgrass decrease in abundance and are replaced by slender wheatgrass, plains bluegrass, green muhly, sedges, rushes, and forbs. If overgrazing or improper haying continues for many years, bluegrass, foxtail barley, and various sedges, rushes, and forbs dominate the site. Overgrazing and operating heavy machinery when the soil is wet cause surface compaction and the formation of mounds and ruts, which make harvesting hay and grazing difficult.

In most areas of this soil in Blaine County, the range is in good condition. The suggested stocking rate is about 1.5 animal unit months per acre. The soil produces a high quantity of low-quality forage. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use in very wet periods helps to maintain or improve the range condition.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. In wetter years, some areas of hay cannot be harvested. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in spring, before the ground thaws and the water table reaches a high level.

This soil is unsuited to the trees and shrubs grown as windbreaks. The high water table is the main limitation. Water-tolerant trees or shrubs for recreational areas or wildlife habitat or for forestation can be established in a few areas. Hand planting or other special management is needed.

This soil is not suitable as a site for sanitary facilities or dwellings because of the ponding. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. They should be shored during dry periods. Constructing local roads on suitable, well compacted fill material above the level of ponding, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by the seasonal high water table.

The land capability unit is Vw-7, dryland; Wetland range site; windbreak suitability group 10.

Ts—Tryon-Els loamy fine sands, 0 to 2 percent slopes. These deep, nearly level soils formed in sandy eolian and alluvial material in sandhill valleys. The Tryon soil is poorly drained, and the Els soil is somewhat poorly drained. These soils are subject to rare flooding. Areas range from 10 to more than 300 acres in size. They are 50 to 60 percent Tryon soil and 30 to 40 percent Els soil. These soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Tryon soil has a surface layer of gray, very friable loamy fine sand about 5 inches thick. Below this is a transitional layer of light brownish gray, mottled, loose fine sand about 8 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand. In some places the surface layer is fine sandy loam or loamy sand. In other places the surface soil is more than 10 inches thick. In some areas this soil is very poorly drained.

Typically, the Els soil has a surface layer of grayish brown, very friable loamy fine sand about 8 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand. In some places the surface layer is loamy sand or sandy loam. In other places the surface soil is more than 10 inches thick.

Included with these soils in mapping are small areas of Ipage and Marlake soils. Ipage soils are higher on the landscape than the Tryon and Els soils and are moderately well drained. Marlake soils are lower on the landscape than the Tryon and Els soils and are ponded during most of the growing season. Included soils make up 5 to 15 percent of this unit.

Permeability is rapid in the Tryon and Els soils, and the available water capacity is low. The organic matter content is high in the Tryon soil and moderately low in the Els soil. Runoff is very slow on the Tryon soil and slow on the Els soil. The seasonal high water table in the Tryon soil is at the surface in wet years to a depth of about 1.5 feet in dry years. Depth to the seasonal high water table in the Els soil ranges from about 1.5 feet in wet years to about 3.0 feet in dry years.

Most of the acreage supports native grasses and is used as range or hayland. These soils are unsuited to cropland because of the high water table in the Tryon soil. A small acreage that is bordered by soils that are better suited to crops is used as irrigated cropland.

In areas used as range, the climax vegetation on the Tryon soil is dominantly switchgrass, indiangrass, big bluestem, and prairie cordgrass. These species make

up 60 percent or more of the total annual forage on this soil. Bluegrass, slender wheatgrass, sedges, and other grasses and forbs make up the rest. The climax vegetation on the Els soil is dominantly big bluestem, little bluestem, indiangrass, and switchgrass. These species make up 85 percent or more of the total annual forage on this soil. Prairie cordgrass, sedges, and other grasses and forbs make up the rest.

If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, prairie cordgrass, switchgrass, and indiangrass decrease in abundance on the Tryon soil and are replaced by sideoats grama, western wheatgrass, Kentucky bluegrass, foxtail barley, green muhly, sedges, and rushes. If the Els soil is subject to continuous heavy grazing or improperly harvested for hay, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance and are replaced by slender wheatgrass, western wheatgrass, plains muhly, and various sedges. If overgrazing continues for many years, bluegrass, western wheatgrass, foxtail barley, and other grasses and forbs dominate the site on the Tryon soil and bluegrass, purple lovegrass, clover, sedges, rushes, and weeds dominate the site on the Els soil. Overgrazing and operating heavy machinery when the soils are wet cause surface compaction and the formation of mounds and ruts, which make harvesting hay and grazing difficult.

If the range is in excellent condition, the suggested initial stocking rate is 1.9 animal unit months per acre on the Tryon soil and 1.7 animal unit months per acre on the Els soil. A planned grazing system that includes proper grazing use, timely deferment of grazing or haying, and restricted use in very wet periods helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

If these soils are used as hayland, mowing should be regulated so that the grasses remain vigorous and healthy. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in spring, before the ground thaws and the water table reaches a high level.

These soils are suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can withstand occasional wetness. Establishing seedlings can be difficult in wet years. The site should be tilled and the trees planted after the soil dries out. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment.

These soils are not suitable as sites for sanitary facilities because of the wetness. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. Shoring and excavation should be done during dry periods. Dwellings in areas of the Els soil should be constructed on raised, well compacted fill material, which helps to overcome the wetness from the seasonal high water table. The Tryon soil is unsuitable as a site for dwellings because of the wetness. Local roads should be constructed on suitable, well compacted fill material. Providing adequate roadside ditches and installing culverts help to prevent the road damage caused by flooding and wetness. A surface drainage system and a gravel moisture barrier in the subgrade minimize the damage caused by frost action.

The land capability unit is Vw-7, dryland. The Tryon soil is in the Wet Subirrigated range site and windbreak suitability group 2D. The Els soil is in the Subirrigated range site and windbreak suitability group 2S.

VaD—Valentine fine sand, 3 to 9 percent slopes. This deep, gently sloping and strongly sloping, excessively drained soil formed in sandy eolian material on uplands. Areas range from 5 to more than 600 acres in size.

Typically, the surface layer is grayish brown, loose fine sand about 6 inches thick. Below this is a transitional layer of brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is pale brown in the upper part and light gray in the lower part. In places the surface layer is loamy fine sand, loamy sand, or sand. In a few places the dark surface soil is more than 10 inches thick.

Included with this soil in mapping are small areas of Els, Hersh, and Ipage soils. These included soils are lower on the landscape than the Valentine soil. Els soils are somewhat poorly drained. Hersh soils are loamy and well drained. Ipage soils are moderately well drained. Also included are small areas of Valentine soils that have a slope of less than 3 percent or more than 9 percent and a few small areas of blowouts. Included soils make up 5 to 15 percent of this unit.

Permeability is rapid in the Valentine soil, and the available water capacity is low. The organic matter content also is low. Runoff is slow. The water intake rate is very high.

Most of the acreage supports native grasses and is used as range (fig. 12). A few areas are used as cropland and are irrigated by sprinkler systems. This soil is unsuited to dryland crops because of the droughtiness and a hazard of soil blowing.

If irrigated, this soil is poorly suited to corn, alfalfa, small grain, and introduced grasses. It is too sandy for gravity irrigation, but sprinkler systems can be used. Frequent, light applications of water help to prevent the excessive leaching of plant nutrients. Soil blowing is a

Figure 12.—A typical area of Valentine fine sand, 3 to 9 percent slopes, which supports native grasses.

serious hazard. Planting close-growing crops, leaving crop residue on the surface, and growing winter cover crops help to control soil blowing. The amount of crop residue that is removed or grazed should be limited. Adding barnyard manure helps to maintain or increase fertility and the content of organic matter.

If this soil is used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage. Blue grama, switchgrass, sand lovegrass, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, sandhill muhly, grasses, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

This soil is suited to the trees and shrubs grown as windbreaks. Because the soil is loose, trees should be planted in shallow furrows with as little disturbance of the surface as possible. Windblown sand can damage young seedlings. Insufficient moisture is a problem. Maintaining strips of sod or other vegetation between the tree rows helps to control the weeds and undesirable grasses that compete with the trees for moisture and reduces the hazard of soil blowing. Areas

near the trees can be rototilled or treated with applications of appropriate herbicide. During periods of insufficient rainfall, supplemental water is needed.

This soil generally is suitable as a site for dwellings and roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored.

The land capability units are VIe-5, dryland, and IVe-12, irrigated; Sands range site; windbreak suitability group 7.

VaE—Valentine fine sand, rolling. This deep, strongly sloping to steep, excessively drained soil formed in sandy eolian material on uplands. Slopes range from 9 to 24 percent. Areas range from 20 to several thousand acres in size.

Typically, the surface layer is grayish brown, loose fine sand about 5 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is pale brown in the upper part and very pale brown in the lower part. In places the surface layer is loamy fine sand, loamy sand, or sand.

Included with this soil in mapping are small areas of Els, Gates, Hersh, Ipage, and Tryon soils. Els and Tryon soils are lower on the landscape than the Valentine soil and have a seasonal high water table. Hersh and Gates soils are finer textured than the Valentine soil and are lower on the landscape. Ipage soils are between areas of the Valentine and Els soils and are moderately well drained. Also included are a few small areas that have a slope of more than 24 percent. Included soils make up 5 to 15 percent of this unit.

Permeability is rapid in the Valentine soil, and the available water capacity is low. The organic matter content also is low. Runoff is slow.

Most areas support native grasses and are used as range. A few areas are used as hayland. This soil is not suitable as cropland because of the droughtiness, a hazard of soil blowing, and the slope.

If this soil is used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage. Blue grama, switchgrass, sand lovegrass, sedges, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, sandhill muhly, annual grasses, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every third year. During the years the forage is not harvested, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

This soil is suited to the trees and shrubs grown as farmstead and feedlot windbreaks (fig. 13). Insufficient moisture is a problem. Because the soil is loose, trees should be planted in shallow furrows with as little disturbance of the surface as possible. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing. Windblown sand can damage young seedlings. Weeds and undesirable grasses can be controlled by applications of appropriate herbicide. Supplemental water is needed during periods of insufficient rainfall.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. Dwellings should be designed so they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. Cutting and filling can provide a suitable grade for local roads.

The land capability unit is VIe-5, dryland; Sands range site; windbreak suitability group 7.

VaF—Valentine fine sand, rolling and hilly. This deep, steep and very steep, excessively drained soil formed in sandy eolian material on uplands. The hilly areas are steeper than the rolling areas and have catsteps on the side slopes (fig. 14). Slopes range from 9 to 60 percent. Areas of this unit range from 40 to several thousand acres in size. The rolling part occupies about 65 percent of the unit and the hilly part about 35 percent.

Typically, the surface layer is grayish brown, loose fine sand about 4 inches thick. Below this is a transitional layer of light brownish gray loose fine sand about 3 inches thick. The underlying material to a depth

Figure 13.—A windbreak of eastern redcedar in an area of Valentine fine sand, rolling.

of 60 inches or more is light gray fine sand. In some areas the surface layer is loamy fine sand.

Included with this soil in mapping are small areas of Els, Gates, Hersh, Ipage, and Tryon soils. Els, Ipage, and Tryon soils are lower on the landscape than the Valentine soil. Els soils are somewhat poorly drained, Ipage soils are moderately well drained, and Tryon soils are poorly drained. Gates and Hersh soils are lower on the landscape than the Valentine soil and are finer textured. Also included are small areas that have a slope of less than 9 percent and a few small areas of blowouts. Included soils make up 5 to 10 percent of this unit.

Permeability is rapid in the Valentine soil, and the available water capacity is low. The organic matter content also is low. Runoff is slow.

The acreage supports native grasses and is used as range. This soil is not suitable for use as cropland because of the slope.

If this soil is used as range, the climax vegetation is dominantly prairie sandreed, sand bluestem, little bluestem, switchgrass, and needleandthread. These species make up 70 percent or more of the total annual forage. Sand lovegrass, blue grama, sandhill muhly, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, sand lovegrass, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, hairy grama, sand dropseed, sandhill muhly, sedges, annual grasses, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is about 0.9 animal unit month per acre on the rolling part and about 0.7 animal unit month per acre on the hilly part. The stocking rate on this unit should be determined by onsite evaluation. It varies, depending on the percentage of the rolling and the hilly

parts in each pasture. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in more uniform distribution of grazing. Livestock cannot easily cross the very steep slopes. Small soapweed can increase in abundance in areas used only as summer pasture, but it can be controlled by using the pasture as winter range. Shaping, seeding, and mulching hasten the reclamation of blowouts.

This soil is generally unsuited to the trees and shrubs grown as windbreaks. In places the trees and shrubs that enhance recreational areas and wildlife habitat can be grown. Hand planting or other special approved practices are needed. Onsite investigation is needed to identify small areas that are suitable for trees and shrubs.

This soil is not suitable as a site for sanitary facilities because of the slope. A suitable alternative site should be selected. The sides of shallow excavations can cave in unless they are shored. Dwellings should be designed so that they conform to the natural shape of the land, or the site should be graded to an acceptable gradient. Extensive cutting and filling can provide a suitable grade for local roads.

The land capability unit is VIIe-5, dryland; windbreak suitability group 10. The rolling part is in the Sands range site, and the hilly part is in the Choppy Sands range site.

Figure 14.—Catsteps in a hilly area of Valentine fine sand, rolling and hilly.

VeB—Valentine loamy fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, excessively drained soil formed in sandy eolian material on uplands. Areas range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 6 inches thick. Below this is a transitional layer of pale brown, very friable loamy fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is very pale brown. It is loamy fine sand in the upper part and fine sand in the lower part. In some places the surface layer is loamy sand or fine sand. In other places the underlying material has strata of loamy material.

Included with this soil in mapping are small areas of Gates, Hersh, and Ipage soils. Gates and Hersh soils are in landscape positions similar to those of the Valentine soil and are finer textured. Ipage soils are lower on the landscape than the Valentine soil and are moderately well drained. Included soils make up 10 to 15 percent of this unit.

Permeability is rapid in the Valentine soil, and the available water capacity is low. The organic matter content also is low. Runoff is slow. The water intake rate is very high.

Most of the acreage supports native grasses and is used as range or hayland. A small acreage is used as cropland.

If dry-farmed, this soil is poorly suited to small grain and alfalfa. Small grain and the first cutting of alfalfa are generally better suited than other crops because they grow and mature in spring when the amount of rainfall is higher. Soil blowing is a serious hazard. Windblown sandy material can destroy young seedlings in early spring. A cropping system that maintains a cover of crops, crop residue, or grass helps to control soil blowing, conserves moisture, and maintains fertility and the content of organic matter.

If irrigated, this soil is poorly suited to corn, alfalfa, and introduced grasses. A sprinkler system is the best method of irrigation. Frequent, light applications of water are needed because of the low available water capacity. These applications help to prevent the leaching of plant nutrients. Returning plant residue to the soil and adding barnyard manure increase the content of organic matter and improve fertility. Leaving crop residue on the surface also helps to control soil blowing.

If this soil is used as range or hayland, the climax vegetation is dominantly little bluestem, sand bluestem, prairie sandreed, needleandthread, and blue grama. These species make up 85 percent of the total annual forage. Switchgrass, sand dropseed, sedges, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. This soil is generally the first to be overgrazed when it is in a pasture that includes Sands or Choppy Sands range sites. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks if soil blowing is controlled by maintaining strips of sod or other vegetation between the tree rows. The droughtiness and competition for moisture from grasses and weeds are problems. Irrigation is needed during dry periods. Cultivating with conventional equipment or applying appropriate herbicide helps to control weeds and undesirable grasses.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. This soil is suitable as a site for dwellings and local roads.

The land capability units are IVe-5, dryland, and IVe-11, irrigated; Sandy range site; windbreak suitability group 5.

VeD—Valentine loamy fine sand, 3 to 9 percent slopes. This deep, gently sloping and strongly sloping, excessively drained soil formed in sandy eolian material on uplands. Areas range from 5 to 300 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 6 inches thick. Below this is a transitional layer of pale brown, very friable loamy fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. In some places the surface layer is sand or fine sand. In other places the surface soil is more than 10 inches thick. In some areas strata of loamy material are below a depth of 40 inches.

Included with this soil in mapping are small areas of Gates, Hersh, and Sandose soils. Gates and Hersh soils are lower on the landscape than the Valentine soil and are finer textured. Sandose soils have loamy material below a depth of 20 inches and are lower on the landscape than the Valentine soil. Included soils make up 5 to 15 percent of this unit.

Permeability is rapid in the Valentine soil, and the available water capacity is low. The organic matter content also is low. Runoff is slow. The water intake rate is very high.

Most of the acreage supports native grasses and is used as range or hayland. The rest is used as cropland. This soil is unsuited to dryland crops because of a hazard of soil blowing and the droughtiness.

If irrigated, this soil is poorly suited to corn, alfalfa, and introduced grasses. It is too sandy for gravity irrigation. A sprinkler system is the best method of irrigation. Frequent, light applications of water help to prevent the leaching of plant nutrients below the root zone. Soil blowing is a hazard. If corn is grown, leaving the maximum amount of crop residue on the surface helps to prevent excessive soil blowing in winter and spring. The amount of crop residue that is removed or grazed should be limited. Planting rye between the corn rows in the fall helps to control soil blowing in areas cut for silage. Keeping tillage to a minimum and growing field windbreaks help to control soil blowing. Applying barnyard manure increases the content of organic matter and improves fertility and the available water capacity.

If this soil is used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up 80 percent or more of the total annual forage. Blue grama, sand lovegrass, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, sand lovegrass, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, Scribner panicum, sand dropseed, needleandthread, and numerous annual and perennial weeds dominate the site. Under these conditions, the native grasses lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to some of the trees and shrubs grown as windbreaks. The only suitable species are those that can grow well in a sandy, droughty soil. Insufficient moisture and soil blowing are the main problems. Irrigation is needed during periods of low rainfall. Because the soil is loose, trees should be planted in shallow furrows with as little disturbance of the surface as possible. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing. Windblown sand can damage young seedlings. Competition for moisture from weeds and undesirable grasses is a problem. Weeds can be controlled by cultivation. Areas near the trees can be hoed by hand or rototilled.

This soil generally is suitable as a site for dwellings and local roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored.

The land capability units are VIe-5, dryland, and IVe-11, irrigated; Sands range site; windbreak suitability group 7.

VmD—Valentine-Els complex, 0 to 9 percent slopes. These deep soils formed in sandy eolian material on uplands. The gently sloping to strongly sloping, excessively drained Valentine soil is on hummocky dunes. The nearly level, somewhat poorly drained Els soil is in sandhill valleys. It is subject to rare flooding. Areas of this unit range from 10 to more than 1,000 acres in size. They are 50 to 65 percent Valentine soil and 20 to 45 percent Els soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Valentine soil has a surface layer of grayish brown, loose fine sand about 4 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 5 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand. In some places the surface layer is loamy fine sand, loamy sand, or sand. In other places the surface soil is more than 10 inches thick.

Typically, the Els soil has a surface layer of grayish brown, very friable loamy fine sand about 6 inches thick. Below this is a transitional layer of light brownish

gray, very friable fine sand about 5 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand. In places the surface layer is sand, fine sand, or loamy sand.

Included with these soils in mapping are small areas of Ipage, Marlake, and Tryon soils. Ipage soils are between areas of the Valentine and Els soils and are moderately well drained. Marlake and Tryon soils are lower on the landscape than the Valentine and Els soils. Marlake soils are very poorly drained and are ponded for long periods of time. Tryon soils are poorly drained or very poorly drained. Also included are some areas that have a slope of more than 9 percent. Included soils make up 5 to 15 percent of this unit.

Permeability is rapid in the Valentine and Els soils, and the available water capacity is low. The organic matter content is low in the Valentine soil and moderately low in the Els soil. Runoff is slow on both soils. The water intake rate is very high. Depth to the seasonal high water table in the Els soil ranges from about 1.5 feet in wet years to about 3.0 feet in dry years.

Most of the acreage supports native grasses and is used as range or hayland. A small acreage is used as irrigated cropland. These soils are unsuited to dryland crops because of the droughtiness and a hazard of soil blowing.

If irrigated, these soils are poorly suited to corn, alfalfa, and introduced grasses. They are too sandy for gravity irrigation but can be irrigated by sprinkler systems. Light, frequent applications of water are needed because of the low available water capacity. These applications help to prevent the leaching of plant nutrients. The high water table in the Els soil can be a problem in the wettest periods. The crops, however, generally benefit from the water table, which subirrigates the soil. Soil blowing is a hazard unless the surface is protected by winter cover crops, close-growing crops, or crop residue. Grazing of the crop residue should be limited. Additions of barnyard manure increase the content of organic matter and improve fertility.

In areas used as range, the climax vegetation on the Valentine soil is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage on this soil. Sand lovegrass, blue grama, switchgrass, and other grasses and forbs make up the rest. The climax vegetation on the Els soil is dominantly big bluestem, little bluestem, indiangrass, and switchgrass. These species make up 85 percent or more of the total annual forage on this soil. Prairie cordgrass, sedges, and annual and perennial grasses and forbs make up the rest.

If subject to continuous heavy grazing or improperly harvested for hay, sand bluestem, little bluestem, sand lovegrass, indiangrass, and switchgrass decrease in abundance. They are replaced by needleandthread, blue grama, sand dropseed, sandhill muhly, annual grasses, and forbs on the Valentine soil and by western wheatgrass, Kentucky bluegrass, foxtail barley, green muhly, sedges, and rushes on the Els soil. If overgrazing continues for many years, the native plants on the Valentine soil lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form. Bluegrass, purple lovegrass, clover, sedges, rushes, and weeds, such as Baldwin ironweed, dominate severely overgrazed areas of the Els soil.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre on the Valentine soil and 1.7 animal unit months per acre on the Els soil. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during wet periods helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If these soils are used as hayland, the mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested only every other year on the Valentine soil. During the year the forage is not harvested, the hayland should be used as fall or winter range. The hay is of best quality when the grasses are cut early on the Els soil.

These soils are suited to the trees and shrubs grown as windbreaks. Because the Valentine soil is loose, trees should be planted in shallow furrows with as little disturbance of the surface as possible. Windblown sand can damage young seedlings. Insufficient moisture is a problem on the Valentine soil. The species selected for planting on the Els soil should be those that can withstand occasional wetness. Establishing the trees can be difficult during wet periods. Planting should be delayed until the soil dries out. Weeds and undesirable grasses that compete with the trees for moisture can be controlled by timely applications of appropriate herbicide.

These soils readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. In areas of the Els soil, adding fill material can raise the absorption field a sufficient distance above the seasonal high water table. The sides of shallow excavations can cave in unless they are shored in areas of both soils. Shoring on the Els

soil should be done during a dry period. The Valentine soil is generally suitable as a site for dwellings and local roads. Dwellings on the Els soil should be constructed on raised, well compacted fill material, which helps to prevent the damage caused by flooding and the high water table. Constructing roads on suitable, well compacted fill material, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by wetness in areas of the Els soil. The damage caused by frost action in the Els soil can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading helps to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-12, irrigated. The Valentine soil is in the Sands range site and windbreak suitability group 7. The Els soil is in the Subirrigated range site and windbreak suitability group 2S.

VoD—Valentine-Sandose loamy fine sands, 0 to 9 percent slopes. These deep soils are on uplands. The gently sloping and strongly sloping Valentine soil is excessively drained. It formed in sandy eolian material. The nearly level and very gently sloping Sandose soil is well drained. It formed in sandy eolian material overlying loamy material. Areas of this unit range from 10 to 200 acres in size. They are 45 to 65 percent Valentine soil and 30 to 45 percent Sandose soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Valentine soil has a surface layer of dark grayish brown, very friable loamy fine sand about 6 inches thick. Below this is a transitional layer of brown, loose fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand. In some places the surface layer is sand, fine sand, or loamy sand. In other places the dark surface soil is more than 10 inches thick.

Typically, the Sandose soil has a surface layer of dark grayish brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is brown, very friable loamy fine sand about 6 inches thick. The subsoil is about 26 inches thick. It is very pale brown, loose fine sand in the upper part; light yellowish brown, very friable very fine sandy loam in the next part; and pale brown, very friable very fine sandy loam in the lower part. The underlying material to a depth of 60 inches or more is light gray very fine sandy loam. In some places the surface layer is sand, fine sand, or loamy sand. In other places sandy material is below a depth of 40 inches or is more than 30 inches thick over the loamy sediments.

Included with these soils in mapping are small areas of Gates, Hersh, and Ipage soils. Gates and Hersh soils are finer textured than the Valentine soil and have less sand in the upper part than the Sandose soil. They are lower on the landscape than the Sandose soil. Ipage soils are moderately well drained and are lower on the landscape than the Valentine soil. Included soils make up 10 to 15 percent of this unit.

Permeability is rapid in the Valentine soil. It is rapid in the upper part of the Sandose soil and moderate in the lower part. The available water capacity is low in the Valentine soil and moderate in the Sandose soil. The organic matter content is low in the Valentine soil and moderately low in the Sandose soil. Runoff is slow on both soils. The water intake rate is high.

Most of the acreage supports native grasses and is used as range. Some areas are used as irrigated cropland. Most areas that formerly were cropland have been reseeded to grass. These soils are unsuited to dryland crops because of the severe erosion hazard on the Valentine soil.

If irrigated, these soils are poorly suited to corn, alfalfa, sorghum, and introduced grasses. Alfalfa and close-growing crops are better suited than row crops. Because of the slope of the Valentine soil and the high rate of water intake, sprinkler systems are the most suitable method of irrigation. Light, frequent applications of water help to prevent the excessive leaching of plant nutrients below the root zone. Soil blowing is a serious hazard where the surface is not protected by crops or crop residue. Returning crop residue to the soil and keeping tillage to a minimum help to control soil blowing and improve fertility. Cover crops or crop residue left on the surface in winter helps to control soil blowing. Adding barnyard manure to these soils increases the content of organic matter and improves fertility.

If these soils are used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage on the Valentine soil and 60 percent or more of the total annual forage on the Sandose soil. Switchgrass, sedges, blue grama, sand lovegrass, sand dropseed, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, sand lovegrass, and little bluestem decrease in abundance on these soils and are replaced by needleandthread, blue grama, hairy grama, sand dropseed, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, Scribner panicum, needleandthread, and numerous annual and perennial weeds dominate the site. Also, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form in areas of the Valentine soil.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

Onsite investigation is helpful in determining sites for windbreaks on this unit. The Sandose soil provides a good site for the trees and shrubs grown as windbreaks, whereas the Valentine soil provides only a fair site because of the droughty nature of the soil and a hazard of soil blowing. Maintaining sod between the tree rows reduces the hazard of soil blowing. Weeds and grasses near the trees can be rototilled or controlled by applications of appropriate herbicide. Trees should be planted in shallow furrows with as little disturbance of the soil as possible in areas of the Valentine soil. Irrigation is needed during periods of low rainfall.

These soils readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The foundation of dwellings with basements can be backfilled with coarse material to prevent the damage caused by shrinking and swelling in areas of the Sandose soil. The Valentine soil generally is suitable as a site for dwellings. Both soils are generally suitable as sites for local roads.

The land capability units are VIe-6, dryland, and IVe-10, irrigated. The Valentine soil is in the Sands range site and windbreak suitability group 7. The Sandose soil is in the Sandy range site and windbreak suitability group 5.

VsD—Valentine-Simeon complex, 0 to 9 percent slopes. These deep, excessively drained soils are on uplands and stream terraces. The gently sloping and strongly sloping Valentine soil formed in sandy eolian material on uplands. The nearly level and very gently sloping Simeon soil formed in sandy alluvium on stream terraces. Areas of this unit range from 20 to 150 acres in size. They are 50 to 70 percent Valentine soil and 20 to 40 percent Simeon soil. The two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Valentine soil has a surface layer of grayish brown, loose fine sand about 4 inches thick. Below this is a transitional layer of brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. In some places the surface layer is loamy fine sand, loamy sand, or sand. In other places the surface soil is more than 10 inches thick. In some areas coarse sand is below a depth of 40 inches.

Typically, the Simeon soil has a surface layer of grayish brown, loose sand about 9 inches thick. Below this is a transitional layer of light brownish gray, loose sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray sand and coarse sand. In some places the surface layer is sandy loam, loamy sand, or fine sand. In other places the surface soil is more than 10 inches thick.

Included with these soils in mapping are small areas of Ipage and Meadin soils. Ipage soils are moderately well drained and are lower on the landscape than the Simeon soil. They are mottled below a depth of 30 inches. Meadin soils have gravelly coarse sand in the underlying material and are in landscape positions similar to those of the Valentine and Simeon soils. Also included are a few small areas of blowouts and a few areas that have slopes of more than 9 percent. Included soils make up 10 to 15 percent of this unit.

Permeability is rapid in the Valentine and Simeon soils, and the available water capacity is low. The organic matter content also is low. Runoff is slow. The water intake rate is very high.

Most of the acreage supports native grasses and is used as range. These soils are unsuited to dryland crops because of the droughtiness and a hazard of soil blowing.

If irrigated, these soils are poorly suited to small grain, corn, introduced grasses, and alfalfa. These soils are too sandy for gravity irrigation but can be sprinkler irrigated. Frequent, light applications of water help to prevent the excessive leaching of plant nutrients below the root zone. Soil blowing is a hazard where the surface is not protected by crops or crop residue. Planting close-growing crops or winter cover crops and leaving crop residue on the surface help to prevent soil blowing. Applications of barnyard manure increase the content of organic matter and improve fertility.

In areas used as range, the climax vegetation on the Valentine soil is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage on this soil. Sand lovegrass, blue grama, switchgrass, and annual and perennial grasses and forbs make up the rest. The climax vegetation on the Simeon soil is dominantly blue grama, prairie sandreed, needleandthread, and sand bluestem. These species make up 70 percent or more of the total annual forage on this soil. Sand dropseed, little bluestem, hairy grama, clubmoss, and other grasses and forbs make up the rest.

If subject to continuous heavy grazing, sand

bluestem, little bluestem, and prairie sandreed decrease in abundance and are replaced by hairy grama, sand dropseed, needleandthread, sedges, annual grasses, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, clubmoss, common prickly pear, fringed sagewort, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre on the Valentine soil and 0.6 animal unit month per acre on the Simeon soil. The rate depends on the percentage of each soil in the pasture and on the range condition. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned, short period of heavy grazing during the grazing season or deferment of grazing in 2 out of 3 years helps to retain little bluestem and prairie sandreed on the Simeon soil. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

Onsite investigation helps to determine sites for windbreaks on these soils. The Valentine soil provides a fair site for the trees and shrubs grown as windbreaks, whereas the Simeon soil is unsuited as a site because of the droughty nature of the soil. The loose surface layer of the Valentine soil can result in damage to young seedlings from windblown sand. Trees should be planted in shallow furrows with as little disturbance of the soil as possible or in a strip where the soil has been treated by nonselective herbicide. Maintaining sod between the tree rows reduces the hazard of soil blowing. Weeds and grasses near the trees can be rototilled or controlled by applications of appropriate herbicide. Supplemental water is needed during dry periods.

These soils readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. These soils generally are suitable as sites for dwellings and local roads. The sides of shallow excavations can cave in unless they are shored.

The land capability units are VIe-5, dryland, and IVe-12, irrigated. The Valentine soil is in the Sands range site and windbreak suitability group 7. The Simeon soil is in the Shallow to Gravel range site and windbreak suitability group 10.

VuC—Vetal loamy fine sand, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loamy and sandy alluvium on stream terraces. Areas range from 10 to more than 50 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is dark gray, very friable loamy fine sand about 11 inches thick. Below this is a transitional layer about 14 inches thick. It is gray, very friable very fine sandy loam in the upper part and gray, very friable fine sandy loam in the lower part. The underlying material to a depth of 60 inches or more is light gray. It is loamy sand in the upper part and sand in the lower part. In places the surface layer is fine sandy loam or fine sand.

Included with this soil in mapping are small areas of Jansen and Valentine soils. Jansen soils are in landscape positions similar to those of the Vetal soil and are sandy and loamy over gravelly coarse sand. Valentine soils are higher on the landscape than the Vetal soil and are sandy throughout. Included soils make up 10 to 15 percent of this unit.

Permeability is moderately rapid in the Vetal soil, and the available water capacity is low. The organic matter content is moderate. Runoff is medium. The water intake rate is high.

Most of the acreage is used as irrigated cropland. The rest supports native grasses and is used as range or hayland.

If dry-farmed, this soil is poorly suited to alfalfa and small grain. The lack of seasonal rainfall is a management concern. Tillage practices that maintain maximum amounts of crop residue on the surface after planting can adequately control water erosion and soil blowing, conserve moisture, and improve tilth. Contour farming also reduces the erosion hazard. A cropping system that includes legumes, grasses, or a mixture of both helps to maintain the content of organic matter and improve fertility.

If irrigated, this soil is suited to corn, alfalfa, sorghum, and introduced grasses. A sprinkler system is the best method of irrigation. Water application rates should be carefully managed to avoid the leaching of plant nutrients below the root zone. Returning crop residue to the soil and keeping tillage to a minimum help to control erosion and maintain fertility. Cover crops or crop residue left on the surface in winter helps to control soil blowing and water erosion. Adding barnyard manure to the soil increases the content of organic matter and improves fertility.

If this soil is used as range, the climax vegetation is dominantly needleandthread, sand bluestem, little bluestem, prairie sandreed, and blue grama. These species make up 85 percent or more of the total annual forage. Sand dropseed, sedges, and other grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem and little bluestem decrease in abundance and are replaced by needleandthread,

prairie sandreed, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, Scribner panicum, sand dropseed, needleandthread, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and water erosion are hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Planting trees on the contour helps to prevent water erosion. The droughtiness and the competition for moisture from undesirable grasses and weeds also are hazards. Irrigation is needed during periods of insufficient rainfall. Cultivation with conventional equipment and timely applications of appropriate herbicide help to control weeds and undesirable grasses.

This soil generally is suitable as a site for septic tank absorption fields and dwellings. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-5, dryland, and IVe-10, irrigated; Sandy range site; windbreak suitability group 5.

Vv—Vetal very fine sandy loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil formed in loamy and sandy alluvium on stream terraces. Areas range from 50 to 600 acres in size.

Typically, the surface layer is dark grayish brown, very friable very fine sandy loam about 7 inches thick. The subsurface layer is dark gray, very friable very fine sandy loam about 15 inches thick. Below this is a transitional layer of light gray, very friable, calcareous very fine sandy loam about 5 inches thick. The upper part of the underlying material is light brownish gray, calcareous loamy fine sand. The lower part to a depth of 60 inches or more is light gray sand. In places the surface layer is loam, fine sandy loam, or loamy fine sand.

Included with this soil in mapping are small areas of Jansen, Sandose, and Valentine soils. Jansen soils are in landscape positions similar to those of the Vetal soil and are loamy over gravelly coarse sand. Sandose and Valentine soils have more sand than the Vetal soil and are higher on the landscape. Also included are small areas that are affected by alkali. Included soils make up 10 to 15 percent of this unit.

Permeability is moderately rapid in the Vetal soil, and the available water capacity is moderate. The organic matter content also is moderate. Runoff is slow. The water intake rate is moderate.

Nearly all of the acreage is used as cropland, most of which is irrigated. A few areas support native grasses and are used as range.

If dry-farmed, this soil is suited to corn, sorghum, small grain, and alfalfa. Crop production is limited in most years because of insufficient rainfall. Soil blowing can be a hazard if the surface is not protected by crops or crop residue. A tillage system that leaves crop residue on the surface helps to conserve moisture. Returning crop residue and adding barnyard manure to the soil and planting green manure crops increase the content of organic matter and improve fertility.

If irrigated, this soil is suited to corn, sorghum, alfalfa, small grain, and introduced grasses. Water can be applied by gravity or sprinkler irrigation systems (fig. 15). Some land leveling may be needed if a gravity system is used. Conservation tillage practices that keep crop residue on the surface conserve soil moisture and help to control soil blowing. Applying barnyard manure and returning crop residue to the soil help to maintain the content of organic matter and fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying depletes the protective cover of native plants. Overgrazing also can result in excessive water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing is a hazard. It can be controlled by maintaining strips of sod or an annual cover crop between the tree rows. Cultivation should be restricted to the tree rows. The lack of rainfall and competition for moisture from weeds and grasses are the main limitations. Supplemental water is needed during periods of insufficient rainfall. Good site preparation, timely cultivation, and timely applications of appropriate herbicide help to control weeds and undesirable grasses.

This soil generally is suitable as a site for septic tank absorption fields and buildings. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by

Figure 15.—Sprinkler irrigation in an area of Vetal very fine sandy loam, 0 to 2 percent slopes, used for corn.

grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIc-1, dryland, and I-6, irrigated; Silty range site; windbreak suitability group 5.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 4,081 acres in the survey area, or less than 1 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in associations 4 and 8, which are described under the heading "General Soil Map Units." Nearly all of this prime farmland is used for crops. The crops grown on this land are mainly corn and alfalfa.

The map units in the survey area that are considered prime farmland are listed at the end of this section. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

The map units that meet the requirements for prime farmland are:

GfC	Gates very fine sandy loam, 3 to 6 percent slopes
HfB	Hersh-Gates complex, 0 to 3 percent slopes
Vv	Vetal very fine sandy loam, 0 to 2 percent slopes

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

Roger Kanable, agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

The acreage of Blaine County is separated into several land uses. The total amount of land used as cropland is minor. About 80 percent of the cropland is irrigated. Corn and alfalfa are the major crops.

Management for Dryland Crops

Good management in areas used for dryland crops reduces the runoff rate, helps to control soil blowing and water erosion, conserves moisture, and improves tilth. Erosion is a hazard on most of the cultivated soils in the county. In places this hazard can be reduced by conservation practices.

Contour farming and a conservation tillage system that keeps crop residue on the surface help to control water erosion. They also reduce the runoff rate and increase the amount of moisture available to crops. Keeping crop residue on the surface or growing a protective plant cover minimizes surface crusting during and after heavy rains, increases the rate of water intake, and reduces the runoff rate. The crop residue also reduces the evaporation rate by lowering the surface temperature. During winter, crop stubble traps snow, which can provide additional moisture.

Soil blowing is a major hazard in Blaine County. It can be controlled by a number of conservation

practices. These include leaving crop residue on the surface throughout the winter until spring planting, applying a conservation tillage system that keeps crop residue on the surface after planting, wind stripcropping, and planting field windbreaks. The hazards of soil blowing and water erosion can be reduced if the more productive soils are used for row crops and if the steeper, more erosive soils are used for close-growing crops, such as small grain or alfalfa, or for hay or pasture.

Insufficient rainfall limits crop production in the county. A cropping system and management practices that control erosion and conserve soil moisture are needed on all of the cropland in the county.

Proper management practices and a suitable cropping sequence help to maintain tilth, fertility, and a plant cover that protects the soil against erosion and help to control weeds, insects, and diseases. The management practices and cropping sequence vary, depending on the kind of soil. For example, management practices on Hersh loamy fine sand, 3 to 6 percent slopes, should include a conservation tillage system that leaves a high percentage of crop residue on the surface after planting, a cover of crop residue during winter, and a contour stripcropping system of row crops and close-growing crops. These conservation practices are needed to reduce both water erosion and soil blowing to an acceptable level.

Conserving soil moisture is the most important factor in the production of dryland crops. No-till or ridge-till planting helps to keep snow on the fields and reduces the evaporation rate. Planting on the contour or contour stripcropping can reduce the runoff rate and increase the infiltration rate.

The kind and amount of fertilizer to be applied should be based on the results of soil tests and on the moisture content of the soil. If the soil is dry or if rainfall is below normal, the amount of nitrogen fertilizer applied should be slightly less than the recommended amount because of the carryover of nitrogen from the previous year. Nitrogen fertilizer is beneficial to nonlegume crops on all soils. Potassium, phosphorus, and zinc are beneficial in severely eroded areas. Dryland crops generally require less fertilizer than irrigated crops because the plant population is lower.

Tillage is sometimes needed to prepare a seedbed and to help control weeds. Excessive tillage reduces the extent of the plant cover and thus increases the hazard of soil blowing. It also breaks down the structure of the surface layer. Tillage practices should be limited to those that are essential. Various conservation tillage practices can be used in the county. No-till planting, ridge-till planting, disc-plant, and chisel-plant systems are well suited to row crops. A seed drill can be used to plant grasses by drilling into a cover of stubble without further seedbed preparation.

Management for Irrigated Crops

About 80 percent of the cropland in Blaine County is irrigated. Corn and alfalfa are grown on most of the irrigated land. Irrigation water is obtained from wells and canals. Sprinkler irrigation can be used in areas where corn is grown. Border, corrugation, or sprinkler irrigation can be used in areas where alfalfa is grown. A cropping system that includes a rotation of corn and alfalfa helps to control the cycle of disease and insects that commonly occurs if a continuous cropping system is used.

Gravity irrigation is suitable for nearly level and very gently sloping soils, such as Hersh-Gates complex, 0 to 3 percent slopes, that are moderately permeable. Furrow irrigation is unsuitable for many of the soils in the county because of a rapid permeability and the slope. Gently sloping soils, such as Gates very fine sandy loam, 3 to 6 percent slopes, are subject to severe water erosion if they are furrow irrigated. These soils are better suited to sprinkler irrigation.

Land leveling improves the efficiency of furrow irrigation by providing an even distribution of water. The efficiency of a furrow irrigation system can be improved by installing a tailwater recovery system, which traps irrigation runoff. The water can then be pumped back on the field and used again.

Because the application of water can be regulated, sprinkler irrigation systems can be used in special conservation practices, such as establishing a new pasture on moderately steep slopes. The most common types of sprinkler irrigation in Blaine County are center-pivot and towline systems. When water is applied by the sprinklers at a controlled rate, it is absorbed and does not run off the surface. Sprinklers can be used on more sloping soils and on sandy soils, which, because of a high rate of water intake, are unsuited to gravity irrigation.

Wind drift can result in an uneven distribution of water under some sprinkler systems. Watering at night, when wind velocities are usually lower, reduces the evaporation rate and improves the distribution of water.

A conservation tillage system that leaves crop residue on the surface is needed on coarse textured soils, such as Ipage loamy sand and Valentine fine sand, to help control soil blowing. Conservation tillage also conserves irrigation water by reducing evaporation, increases the rate of water intake, reduces runoff, and helps to control water erosion.

Sandy soils, such as the Ipage soils, hold a limited amount of water and thus need irrigation water at regular intervals. Application rates and frequency vary,

depending on the soil, the crop, and the amount of available moisture in the soil. If erosion is a hazard, the application rate should not exceed the rate of water intake of the soil.

The available water capacity varies widely in areas of irrigated soils in Blaine County. For example, the Gates soil in an area of Hersh-Gates complex, 0 to 3 percent slopes, holds about 2.3 inches of water per foot of soil. Thus, when planted to a crop that has roots extending to a depth of 4 feet, this soil supplies about 9.2 inches of available water to the crop. When planted to the same crop, a sandy soil, such as Valentine loamy fine sand, supplies about 4 inches of available water in 4 feet of soil. An irrigation system should be planned that can replace water at a rate that ensures a steady water supply for the plants *(7)*.

Typically, irrigated crops remove more nutrients from the soil than nonirrigated crops. Returning all crop residue to the soil and adding livestock manure and commercial fertilizer help to maintain the supply of nutrients. The grain crops grown in Blaine County respond well to applications of nitrogen fertilizer. In areas where the surface has been disturbed during land leveling operations, especially where the topsoil has been removed, plants respond well to applications of phosphorus, potassium, zinc, and iron. On sandy soils that have a low water-holding capacity, such as Ipage and Valentine, plant nutrients can be quickly leached below the root zone. On these soils, fertilizer can be applied at frequent intervals along with the irrigation water. Carefully controlling the amount of water applied helps to prevent the loss of plant nutrients. Soil tests can determine the amount and kind of fertilizer needed on specific sites for specific crops.

Assistance in planning and designing an irrigation system is available through the local offices of the Soil Conservation Service or from the county agricultural agent. Estimates of the cost of irrigation equipment can be obtained from local dealers and manufacturers.

Weed Control

Management techniques, such as crop rotations, help to control weeds. Rotating different crops in a planned sequence not only helps to control weeds but also increases the productivity of the soil and the content of organic matter.

Applications of approved herbicide also are an effective way to control weeds. The kind and amount of herbicide applied to the soil should be carefully controlled. The colloidal clay and humus fractions of the soil are responsible for most of the chemical activity in the soil. Excessive amounts of herbicide can damage crops on sandy soils, which have a low content of clay, and on soils that are low in content of organic matter. Consequently, herbicide application rates need to be lowered correspondingly on these soils. The Nebraska Cooperative Extension Service Guide "Herbicide Use in Nebraska" is a good source of information about weed control.

Management of Pasture

Pasture should be managed for maximum forage production. After the pasture is established, the grasses should be kept productive. In Blaine County pastures of introduced grasses consist mainly of cool-season grasses, which start to grow early in spring and reach their peak growth in May or June. These grasses are dormant during July and August and start to grow again in the fall if moisture is available. For this reason, additional pastures of warm-season grasses or temporary pastures of sudangrass, which attains peak growth during July and August, are desirable. The combination of cool- and warm-season grasses provides forage during the entire growing season.

Grasses and legumes used for both dryland and irrigated pastures should be grazed in a rotation that allows for plant regrowth. A planned grazing system in which pastures of cool-season grasses are grazed in rotation extends the grazing season and increases forage production. The most commonly grown introduced grasses on cool-season pastures are smooth bromegrass and intermediate wheatgrass. Other suitable cool-season grasses and legumes in Blaine County are orchardgrass, creeping foxtail, meadow bromegrass, reed canarygrass, alfalfa, birdsfoot trefoil, and cicer milkvetch. If planted as a single species on nonirrigated land, some native, warm-season grasses can be grown along with cool-season grasses in order to improve forage quality during the grazing season. Switchgrass, indiangrass, and big bluestem are native, warm-season grasses that can be used in a planned system of grazing to provide high-quality forage during the summer.

Introduced pasture grasses can be grazed in the spring and fall after they reach a height of 5 or 6 inches. Until they reach this height, they grow on food reserves stored in their roots and rhizomes. Grazing too early in spring or too late in fall weakens the plants.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map

unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local offices of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-6 and IVe-5.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed Soil Map Units," in the yields table, and in the

"Interpretive Groups" section, which follows the tables at the back of this survey.

Rangeland

Kenneth L. Hladek, range conservationist, Soil Conservation Service, helped prepare this section.

Rangeland makes up about 95 percent of the land in Blaine County. Most of the acreage is in the Valentine, Valentine-Ipage, and Valentine-Els-Ipage associations. These areas are used primarily for grazing by livestock. A small acreage is used for native hay. In addition, some of the cropland in the county produces supplemental feed for livestock. Ranching is the most important agricultural enterprise in the county. Therefore, proper management of range and hayland is the most important part of the conservation program in Blaine County. Good range management can improve forage yields and thus increase livestock production.

This section can aid ranchers and conservationists in planning the management of range. It defines range sites, explains the evaluation of range condition, and describes planned grazing systems and other aspects of range and hayland management.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for nearly all the soils, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Range condition is the present state of the vegetation on a range site compared with the potential, or climax vegetation, for that site. Climax vegetation is a stable plant community that represents the most productive combination of forage plants on a given range site. It reproduces itself naturally and changes little as long as the climate and soil conditions remain unchanged.

Determining the range condition provides an approximate measure of the deterioration of the plant community. More importantly, it provides a basis for predicting the degree of improvement possible under different kinds of management. Four condition classes

are used to indicate the departure from the potential, or climax vegetation. They are excellent, good, fair, and poor.

All food that plants use for growth is manufactured in their leaves. Removal of plant leaves during the growing season affects the growth of both roots and shoots. Livestock graze selectively, removing more leaves from some plants than from others. This selective grazing varies according to the season and the degree of range use. Plants respond to grazing in different ways. Some decrease in abundance, some increase in abundance, and others not originally part of the plant community invade. Plant responses to grazing are used in classifying the range condition.

The *decreaser species* are those in the original plant community that decrease in abundance if grazed closely during the growing season. The *increaser species* are those in the original plant community that normally increase in abundance, at least for a time, as the decreaser plants become less abundant. The *invader species* are those not in the original plant community that begin to grow on a site after the decreaser and increaser species have been removed or have become less extensive.

Once the range condition has been determined, it is important to know whether the range is improving or deteriorating in order to plan adjustments in grazing use and management. Important factors affecting trends in the plant community are the vigor and reproductive capacities of both desirable and undesirable species.

Excellent range condition is the goal of range management (fig. 16). The highest forage yields are obtained on a sustained basis when the range is in excellent condition. In addition, soil blowing and water erosion are controlled without conservation practices and maximum use is made of rainfall and snowmelt.

The following paragraphs describe the management needed on the range in Blaine County. The management includes proper grazing use, a planned grazing system, deferred grazing, range seeding, control of blowouts and brush, and proper haying methods.

Proper Grazing Use

Proper grazing use is grazing at an intensity that maintains enough plant cover to protect the soil and that maintains or improves the quantity and quality of desirable vegetation. It is the first and most important step in successful range management. It increases the vigor and reproductive capacity of desirable plants, leaves enough accumulated litter and mulch on the surface to control erosion, and increases forage production. The proper intensity of grazing on range used during the entire season removes half of the current year's growth.

Proper grazing use is determined by the degree to which desirable species are grazed in key areas. It is affected by stocking rates, distribution of livestock, and the kinds and classes of livestock.

The stocking rate is the number of grazing animals in a particular pasture. It is based on animal units and animal unit months. An *animal unit* is a measurement of livestock numbers based on the equivalent of one mature cow and a 6-month-old calf. An *animal unit month* (AUM) is the forage or feed necessary to sustain an animal unit for 1 month. The range site for each map unit and the range condition are used to determine the animal unit months. The proper stocking rates for range sites in excellent condition are given for many of the soils under the heading "Detailed Soil Map Units." The rates are lower for range sites in less than excellent condition.

In an area of Valentine fine sand, rolling, the suggested initial stocking rate is about 0.9 animal unit month per acre if the range is in excellent condition. Thus, a 640-acre pasture in excellent condition can carry about 576 animal units for 1 month. If the pasture is to be grazed for 5 months, then the suggested initial stocking rate would be about 115 animal units. This rate is based on the existing plant community and the average annual production of each site. Because of weather conditions, forage production varies. The suggested rate is intended as an initial stocking rate and should be adjusted to change in forage production or the management system.

The proper distribution of livestock throughout a pasture requires planning. Livestock tend to graze most heavily in areas near livestock watering and salting facilities, in areas near roads and trails, and in the more gently sloping areas. Distant corners of pastures and steep areas may be undergrazed. Poor grazing distribution can result from too few watering facilities or from poorly distributed watering and salting facilities, shade, and supplemental feed. A continued concentration of livestock causes severe overuse in parts of a pasture, leaving other parts underused. Carefully locating fences and salting and watering facilities helps to achieve a uniform distribution of grazing.

Fences help to distribute grazing in a more uniform pattern. Also, they can divide pastures into sections used in a planned grazing system and can isolate blowouts and reseeded areas. Cross fences should be located so that they follow natural land features and range sites as much as possible. The potential stocking rate should be similar throughout a given pasture. Generally, the smaller pastures are managed more

Figure 16.—A Sands range site in excellent condition in an area of Valentine fine sand, 3 to 9 percent slopes.

efficiently than the larger ones. This efficiency should be considered when the pasture size is determined.

Properly locating salting facilities is one of the easiest methods of achieving a more uniform distribution of grazing in a pasture. The salting facilities should be located away from water facilities. Salt can be easily moved to areas that are undergrazed and can be relocated at different times throughout the grazing season. On Sands and Choppy Sands range sites, relocating the salting station each time that salt is provided lessens the hazard of soil blowing.

Properly located watering facilities also can improve the distribution of grazing. In Blaine County, most livestock water is provided by wells and perennial streams. Windmills pump the water for most of these wells. Some dugouts are on the wetter range sites, and a few stockwater dams are in areas of the Valentine-Hersh-Gates association. Watering facilities should be spaced at varying distances, depending on the terrain. In rough or hilly areas, the distance between facilities should not be more than 0.5 mile. In the more level areas, it should be no more than 1 mile. If the distance is too far, the areas near water sources will be overgrazed.

Range management is also dependent on the kinds and classes of livestock grazing the pasture. Cattle, sheep, and horses have different grazing habits and nutritional needs. Grazing habits differ among classes of cattle. Yearlings will graze the steeper areas and will graze a pasture more uniformly than cows with calves. They trail along fence lines, however, and can create blowouts. Cow-calf pairs graze for longer periods on the gentler slopes and stay close to watering facilities. As a result, poor grazing distribution may be more of a problem in pastures stocked with cows and calves than in those stocked with yearlings.

Planned Grazing Systems

Planned grazing systems are effective in achieving maximum forage production and in controlling erosion and blowouts. In a planned grazing system, two or more pastures are alternately rested and grazed in a planned sequence over a period of years. The rest period may be throughout the year or during all or part of the growing season. The same pasture is not grazed during the same period 2 years in a row. As a result, plant vigor, the plant community, and the range condition are improved.

Planned grazing systems result in a more uniform distribution of grazing and help to maintain maximum productivity over a period of years. They help to overcome the adverse effects of drought or other climatic conditions on plants. They should be designed to meet the needs of the rancher. The location of fences and of watering facilities, range sites and condition classes, the kinds or classes of livestock, and economic factors are used to determine the best system for a particular ranch operation. Planned grazing systems can eventually increase the stocking rates in the pastures. They also help to control parasites and diseases among cattle because they generally result in cleaner pastures.

Deferred Grazing

Deferred grazing allows the plants a prolonged period of rest. If grazing is deferred throughout the growing season, the plant community can improve rapidly. The undisturbed grasses leave a mulch at the surface and thus increase the rate of water infiltration and reduce the susceptibility to erosion. Deferred grazing allows the desirable species to mature and flower and to seed naturally.

The need for deferment is based on the range condition. To be beneficial, deferment should be for a minimum of 3 consecutive months and should coincide with the food-storage period of the desirable plants. This period varies, depending on the grass species. It is usually August to October for warm-season grasses. On some sites a deferment of 3 months is all that is needed, while on other sites a deferment of two complete growing seasons may be needed. Following the period of deferment, the pasture can be grazed after the first significant frost in the fall and early in the spring.

Range Seeding

In some areas range management alone cannot restore a satisfactory cover of native vegetation. Some of these areas are formerly cultivated fields, abandoned farmsteads, and sites where the original native vegetation has been removed. Range seeding may be needed in these areas.

Good stands of native grasses can be reestablished if the seedbed is properly prepared, adapted species of native grasses are selected for planting, the correct seeding methods are employed, and careful management is applied after seeding. Range seeding is most successful when the seedbed has a cover of mulch. This cover helps to keep the soil moist, lowers the temperature of the surface soil, and helps to control erosion. A temporary crop, such as sudangrass or grain sorghum, can provide a cover of mulch. The grass should be seeded directly into the stubble the following fall, winter, or spring. Tillage should be avoided because a firm seedbed is needed. On the sandier soils, preparing the seedbed and planting the seeds in narrow strips over a period of several years or using a range interseeder helps to control soil blowing.

Seeding mixtures should consist of suitable native grass species that are normally on the site. Consequently, they vary according to the range site. Use of a grassland drill with depth bands ensures good placement of seeds at a uniform depth. On soils in the Sands and Choppy Sands range sites and on other soils where seedbed preparation will result in a severe hazard of soil blowing, a range interseeder should be used.

Newly seeded areas should not be grazed until after the grass is established. Establishment may take 2 or 3 years, depending on the grass species, the range site, and the method of planting. Initial grazing of these areas should be light. Grazing late in fall and in winter is desirable until the grass cover has reached the desired density.

Additional information about appropriate grass mixtures, grassland drills, and planting times can be obtained from the local offices of the Soil Conservation Service and the Upper Loup Natural Resources District.

Control of Blowouts

Blowouts form in areas of sandy soils where tillage or heavy grazing has removed the vegetation. Most blowouts in the sandhills are along livestock trails or in overgrazed areas. Many large blowouts have formed on sites for wells, where livestock tend to concentrate. Smaller blowouts generally form along trails or fence lines. Drought increases the likelihood that blowouts will form.

Unless stabilized, blowouts are likely to enlarge as the wind blows the bare sand to the bordering areas. This windblown sand smothers the vegetation in those areas. A planned grazing system can stabilize many blowouts in 4 or 5 years. A stable grade should be

established on the steep banks around the edge of the blowout. Otherwise, the steep slopes cannot be revegetated and will be a constant source of shifting sand. Locating wells and salting facilities away from the blowout helps to prevent the concentration of livestock in the area.

Reseeding may be necessary in areas where a natural seed source is not available and in areas of large blowouts. Fences are needed to keep livestock away from the blowout. The edge of the blowout should be shaped to a suitable grade. If a fast-growing summer cover crop is planted in the spring, a suitable mixture of native grass can be drilled into the stubble left from the crop. The cover crop helps to control soil blowing and creates a good seedbed. If a cover crop is not practical, a mulch of native hay can be spread over the surface and worked into the sand. After the blowout is seeded, the mulch helps to prevent the damage caused by windblown sand while the grasses are becoming established. Proper grazing use and a planned grazing system help to prevent the reactivation of stabilized blowouts after the grasses are established.

Brush Control

Small soapweed, western snowberry, eastern redcedar, sumac, and American plum are the main brush species in Blaine County. They encroach on the land, shade out desirable grasses, and reduce forage yields. Western snowberry, eastern redcedar, sumac, and American plum grow mainly in areas of loess and in transitional areas between deposits of loess and deposits of sand. Small soapweed can be a problem on Choppy Sands and Thin Loess range sites. It can be controlled by selective grazing. If it is grazed during the winter, it loses vigor and may be broken off below the root crown. Using cottonseed cake as a protein supplement increases the amount of small soapweed that cattle consume. Approved herbicides are effective only in spots.

Approved herbicides are the best means of controlling western snowberry, sumac, and American plum. Repeated applications may be needed during succeeding years. Further information about the use of herbicides can be obtained from the local offices of the Soil Conservation Service and the Cooperative Extension Service.

Cutting is the best means of controlling eastern redcedar. The trees should be cut at ground level, below any green tissue. They can be cut by hand or by earthmoving equipment where the slope and topography are suitable. Generally, followup cutting is necessary after earthmoving equipment is used. Approved herbicides or hand cutting can help in removing the rest of the trees. Deferment of grazing after the use of earthmoving equipment or chemicals helps to restore plant vigor and forage quality.

Management of Native Hayland

Many areas of range in Blaine County are used for native hay. In most of these areas, the soils have a seasonal high water table and are in the Wetland, Wet Subirrigated, and Subirrigated range sites. Hay is harvested in a few upland or valley areas usually used for grazing. These areas generally are in the Sandy Lowland, Sandy, or Sands range site.

Proper management can maintain or improve hay production on the wet meadows. Timely mowing is needed to maintain strong plant vigor and a healthy stand. If mowing is deferred during the period between the boot stage and seed maturity, the plant roots can store more carbohydrates. The boot stage is just prior to the emergence of seed heads. Large meadows can be divided into three sections, and the sections can be mowed in rotation. One section should be mowed about 2 weeks before the plants reach the boot stage; another section, at the boot stage; and the last section, early in the flowering period. The order in which the sections are mowed should be changed in successive years. A mowing height of 3 inches or more helps to maintain plant vigor.

Meadows should not be grazed or harvested for hay when the soil is wet or the water table is within a depth of 6 inches. Grazing or operating heavy machinery during these periods can result in the formation of small bogs, ruts, or mounds, which can hinder mowing in later years. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws and the soil becomes wet in the spring.

Applications of phosphorous fertilizer increase forage production on wet meadows. They stimulate the growth of clover and grasses and thus increase the value and yield of hay.

If the drier sites are used for hay, the forage should be harvested only every other year. During the following year, grazing only in fall or winter allows the warm-season grasses to gain vigor and decreases the abundance of cool-season grasses and of weeds. The optimum time for mowing is just before the dominant grasses reach boot stage. Mowing should be regulated so that the desirable grasses remain vigorous and healthy. Early mowing allows the plants enough time to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply (fig. 17).

Technical assistance in managing range and hayland can be obtained from the local offices of the Soil Conservation Service and the Upper Loup Natural Resources District.

Figure 17.—An area of native grass used for hay. On the right, plant regrowth holds snow on the surface. On the left, the hay was harvested too late for regrowth to occur.

Windbreaks and Environmental Plantings

Keith Ticknor, forester, Soil Conservation Service, helped prepare this section.

Windbreaks and environmental plantings have been planted at various times on most ranch headquarters in Blaine County. Windbreaks are also used to protect fields and livestock. These plantings consist of several rows of evergreen and deciduous trees and shrubs. Eastern redcedar, Siberian elm, and eastern cottonwood are the dominant species. Other species include black locust, ponderosa pine, green ash, boxelder, honeylocust, blue spruce, Russian olive, mulberry, lilac, common chokecherry, honeysuckle, and Siberian peashrub.

Planting trees and shrubs is a continuing process because old ones pass maturity and deteriorate and because some are destroyed by insects, diseases, or storms. Also, new windbreaks are needed in areas where farming or ranching is expanding.

Windbreaks that protect livestock are in scattered areas of range throughout the county. Most of these windbreaks consist of several rows of eastern redcedar (fig. 18).

Field windbreaks are common in the county, especially in the valleys and in areas of the Els and Ipage soils. Most of these windbreaks consist of several rows of trees and shrubs. Species include eastern redcedar, Siberian elm, ponderosa pine, green ash, hackberry, eastern cottonwood, lilac, American plum, common chokecherry, skunkbush sumac, American elm, black locust, honeylocust, and Russian mulberry. A few field windbreaks consist of a single row of eastern cottonwood. Many of the trees and shrubs were planted under the Prairie States Tree Planting Program in the 1930's and 1940's.

The species of trees and shrubs grown as windbreaks and environmental plantings should be those that are suited to the soils on the selected site. Choosing the proper species is the first step in ensuring plant survival and a maximum growth rate. Permeability, available water capacity, fertility, soil depth, and soil texture greatly affect the growth rate.

Establishing trees and shrubs is difficult in Blaine

County because of the dry conditions and the competition from other vegetation. Preparing the site properly before planting and controlling competition from weeds and grasses after planting are important management objectives. Supplemental watering is needed when the seedlings are becoming established. Dead trees should be replaced during the first 3 years after planting.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and

Figure 18.—Rows of eastern redcedar in an area of Valentine fine sand, 3 to 9 percent slopes, provide protection for livestock that calve in spring.

screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Native Woodland

Keith Ticknor, forester, Soil Conservation Service, helped prepare this section.

Woodland makes up less than 1 percent of the land area in Blaine County. Most of the woodland occurs along the North Loup and Middle Loup Rivers. Other native woody vegetation grows on the edge of wet areas and on steep slopes in areas of the Valentine-Hersh-Gates association.

The woodland vegetation depends on the availability of ground water along the rivers. It is maintained at less than the climax vegetation of a deciduous forest because of the semiarid environment and the lack of seed sources. The Almeria-Ipage-Fluvaquents association has the largest concentration of woodland. Eastern cottonwood, peachleaf willow, indigobush, and dogwood are the dominant species. Other species include green ash, sandbar willow, riverbank grape, golden currant, American plum, common chokecherry, gooseberry, and western snowberry.

A few eastern cottonwood, peachleaf willow, sandbar willow, and indigobush grow in sandhill valleys on the edge of wet areas and in areas that have a perched water table. In addition, some steep, north-facing slopes support clumps of American plum, western sandcherry, and western snowberry. These areas are plentiful in the southern part of the county but rarely occur in the northern half.

A small, unique area in the southeast corner of the county occurs as dense woodland on steep slopes. This area is in the Valentine-Hersh-Gates association. It is representative of the Hackberry-American Elm-Green Ash forest cover type. Hackberry, common chokecherry, and western snowberry generally are the dominant species. Eastern redcedar is dominant in the drier areas at the top of hills. Species in the low areas include smooth sumac, golden currant, green ash, American plum, gooseberry, boxelder, American elm, riverbank grape, and eastern cottonwood.

Some of the trees are cut for firewood. The commercial use of woodland, however, is very limited because the wooded areas generally are not large enough to be economically harvested.

The county has a few tracts of woodland that were planted under the Timber Claim Act. These tracts generally consist of pure stands of green ash, black locust, or eastern cottonwood.

Recreation

Mike W. Anderson, biologist, Soil Conservation Service, helped prepare this section.

The chief recreational activities in Blaine County presently are hunting, trapping, and fishing. The landowners' permission may be needed for these activities. Prairie grouse, mule deer, and whitetail deer are popular game species. Mourning dove are hunted throughout the county during the hunting season. Hunting for pheasant and bobwhite quail is limited to areas where cropland, woodland, and grassland merge and along the North Loup, Middle Loup, and Dismal Rivers. Furbearers are also trapped along those rivers. Some stretches along the rivers are suitable for canoeing.

Catfish, bullhead, bluegill, largemouth bass, walleye, and northern pike are in the North Loup, Middle Loup, and Dismal Rivers. Some private ponds are stocked with largemouth bass, bluegill, and catfish (fig. 19). Because of the recent establishment of a managed fishery, excellent fishing for a variety of game and panfish species is available. The fish and wildlife resources are managed by the Nebraska Game and Parks Commission.

Technical assistance in designing recreational facilities or improving wildlife habitat is available at the local offices of the Soil Conservation Service.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design,

Figure 19.—A pond on bottom land along the Middle Loup River. The high water table is a good source of water for lakes and ponds that are used for recreation.

intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The

surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Mike W. Anderson, biologist, Soil Conservation Service, helped prepare this section.

The kinds of wildlife habitat in Blaine County vary, depending on the soil, topography, vegetation, slope, and drainage pattern. The general soil map at the back of this survey provides a guide to the soil associations described in this section and their respective habitats.

The Valentine, Valentine-Ipage, Valentine-Els-Ipage, Valentine-Hersh-Gates, and Ipage-Valentine-Simeon associations provide habitat for rangeland wildlife. The rangeland wildlife includes mule deer, whitetail deer, badger, coyote, skunk, jackrabbit, ground squirrel, meadowlark, bob-o-link, and lark bunting. Wildlife habitat is available near the depressional areas of wetlands in the Valentine-Els-Ipage association. The wetland wildlife includes shore birds, waterfowl, mink, muskrat, and other related species.

Habitat on uplands of the sandhills consists mostly of grasses, such as sand bluestem, little bluestem, prairie sandreed, and blue grama. Common shrubs and forbs include sand cherry, chokecherry, leadplant, poison ivy, coneflower, purple prairie-clover, ragweed, and sunflower. In the wetter areas, big bluestem, switchgrass, prairie cordgrass, cattails, sedges, pondweeds, and rushes are common.

During the winter months, the wildlife species are attracted to areas that provide food and protective cover. Examples are livestock feeding areas, woody cover in draws, field windbreaks, and shelterbelts. In the sandhills, areas of woody cover are sparse. Planting conifers, such as eastern redcedar, in 1-acre blocks in a checkerboard pattern can greatly increase the amount of winter cover and protective cover available to prairie grouse, deer, and upland game birds. Areas of cultivated cropland that can provide food for wildlife are generally limited to stream terraces and bottom land along the Dismal, North Loup, and Middle Loup Rivers.

The areas along the North Loup and Middle Loup Rivers offer a good variety of cover types. These areas include cropland, hayland, and rangeland that are interspersed with woody riparian bottom land. Other woody cover, occurring as windbreaks or shelterbelts, is more common in the associations along streams. Food, cover, and water are available in or near these associations for many wildlife species, including whitetail deer, mule deer, bobwhite quail, cottontail, jackrabbit, and ring-necked pheasant. These animals use the riparian habitat along the North Loup and Middle Loup Rivers as escape cover. They venture out to the cropland to feed.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain

and seed crops are corn, wheat, oats, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, intermediate wheatgrass, tall wheatgrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are little bluestem, goldenrod, western wheatgrass, and blue grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are green ash, honeylocust, hackberry, and eastern cottonwood. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian olive, common chokecherry, and American plum.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are ponderosa pine, eastern redcedar, and Rocky Mountain juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are sand cherry, honeysuckle, western snowberry, and sumac.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, prairie cordgrass, rushes, sedges, and northern reedgrass.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas (fig. 20). Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, and cottontail.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, thrushes, woodpeckers, squirrels, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, prairie grouse, meadowlark, and lark bunting.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were

Figure 20.—A shallow water area used by livestock, migratory waterfowl, and other wildlife.

not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; gravel content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the

effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil

layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage

potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

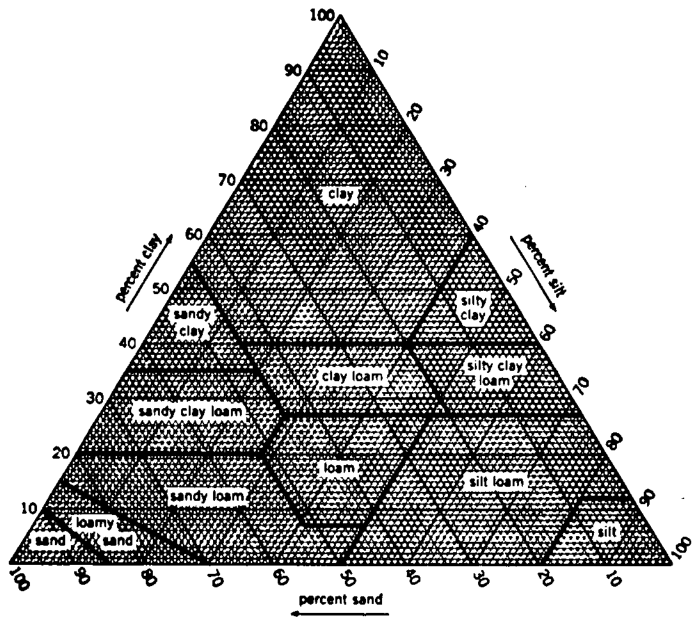

Figure 21.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 21). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. In Nebraska, the group index numbers range from -4 for the best subgrade material to 32 for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 18.

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can severely restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for

fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced

electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Nebraska Department of Roads.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM); and Specific gravity T—100 (AASHTO). The group index number that is part of the AASHTO classification is computed by using the Nebraska Modified System.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(6)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fluvaquents (*Fluv*, meaning river, plus *aquent*, the suborder of the Entisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy, mixed, mesic Typic Fluvaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(5)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(6)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Almeria Series

The Almeria series consists of deep, poorly drained and very poorly drained, rapidly permeable soils that

formed in sandy alluvium on bottom land. Slopes range from 0 to 2 percent.

Almeria soils are commonly near Bolent and Calamus soils and Fluvaquents. Bolent and Calamus soils are higher on the landscape than the Almeria soils and are better drained. Fluvaquents are lower on the landscape than the Almeria soils and have water on the surface for most of the growing season.

Typical pedon of Almeria loamy fine sand, 0 to 2 percent slopes, 2,100 feet west and 2,350 feet north of the southeast corner of sec. 33, T. 22. N., R. 24 W.

A—0 to 4 inches; gray (10YR 6/1) loamy fine sand, dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable; strata of grayish brown (10YR 5/2) fine sand; neutral; clear smooth boundary.

C1—4 to 12 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; common fine and medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; few thin strata of fine sandy loam; slightly acid; clear smooth boundary.

C2—12 to 24 inches; gray (10YR 6/1) fine sand, gray (10YR 5/1) moist; common medium and fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; few thin strata of fine sandy loam; slightly acid; gradual smooth boundary.

C3—24 to 60 inches; white (2.5Y 8/2) sand, light gray (2.5Y 7/2) moist; single grain; loose; few thin strata of loamy sand, coarse sand, and fine sandy loam; neutral.

These soils typically do not contain free carbonates, except for the upper few inches in some pedons.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 6 (2 to 5 moist), and chroma of 1 to 3. It is typically loamy fine sand, but the range includes fine sand, loamy sand, and fine sandy loam. This horizon ranges from 2 to 9 inches in thickness. A few pedons have an AC horizon. This horizon has colors intermediate between those of the A and C horizons. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 8 (2 to 7 moist), and chroma of 1 or 2. It is dominantly sand or fine sand, but it commonly has strata of loamy fine sand to loam and in some pedons has thin strata of coarse sand and gravelly coarse sand.

Bolent Series

The Bolent series consists of deep, somewhat poorly drained, rapidly permeable soils that formed in sandy alluvium on bottom land. Slopes range from 0 to 2 percent.

Bolent soils are commonly near Almeria and Calamus soils and Fluvaquents. Almeria soils are lower on the landscape than the Bolent soils and are poorly drained and very poorly drained. Calamus soils are higher on the landscape than the Bolent soils and are moderately well drained. Fluvaquents are in the lowest positions on bottom land and have water on the surface for most of the growing season.

Typical pedon of Bolent loamy sand, 0 to 2 percent slopes, 2,600 feet north and 2,400 feet west of the southeast corner of sec. 34, T. 23 N., R. 21 W.

A—0 to 5 inches; dark gray (10YR 4/1) loamy sand, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; mildly alkaline; clear wavy boundary.

C1—5 to 15 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; few thin strata of loamy fine sand and fine sandy loam; neutral; abrupt smooth boundary.

C2—15 to 24 inches; white (10YR 8/2) fine sand, light gray (10YR 7/2) moist; common medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; few thin strata of loamy fine sand and fine sandy loam; neutral; clear smooth boundary.

C3—24 to 42 inches; white (10YR 8/1) sand, light gray (10YR 7/1) moist; common medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; few thin strata of loamy fine sand; neutral; clear smooth boundary.

C4—42 to 60 inches; white (10YR 8/2) sand, light gray (10YR 7/2) moist; few medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; few thin strata of coarse sand; neutral.

These soils are typically noncalcareous, except for the surface layer of some pedons.

The A horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. It is typically loamy sand, but the range includes fine sandy loam and loam. The AC horizon, if it occurs, has colors and textures intermediate between those of the A and C horizons. The C horizon has hue of 10YR or 2.5Y, value of 4 to 8 (3 to 7 moist), and chroma of 1 to 3. It has brownish, reddish, or yellowish mottles. It is dominantly sand, fine sand, or loamy sand but has strata of loam to coarse sand. Some pedons have buried soils below a depth of 40 inches.

Calamus Series

The Calamus series consists of deep, moderately well drained, rapidly permeable soils that formed in sandy alluvium on bottom land. Slopes range from 0 to 2 percent.

Calamus soils are commonly near Almeria, Bolent, and Ipage soils. Almeria and Bolent soils are lower on

the landscape than the Calamus soils. Almeria soils are poorly drained and very poorly drained. Bolent soils are somewhat poorly drained. Ipage soils do not have coarse sand or coarser material within a depth of 40 inches. They are on stream terraces and in sandhill valleys.

Typical pedon of Calamus loamy sand, 0 to 2 percent slopes, 2,500 feet west and 2,500 feet north of the southeast corner of sec. 29, T. 24 N., R. 24 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; medium acid; abrupt smooth boundary.

A—4 to 8 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

C1—8 to 17 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; single grain; loose; neutral; clear smooth boundary.

C2—17 to 30 inches; white (10YR 8/2) sand, light brownish gray (10YR 6/2) moist; single grain; loose; thin strata of coarse sand that has 3 percent gravel, by volume; neutral; clear smooth boundary.

C3—30 to 60 inches; white (10YR 8/2) sand, light brownish gray (10YR 6/2) moist; common medium prominent dark yellowish brown (10YR 4/6 moist) mottles; single grain; loose; thin strata of coarse sand that has 8 percent gravel, by volume; neutral.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loamy sand, but the range includes loamy fine sand and fine sand. This horizon is 3 to 9 inches thick. The AC horizon, if it occurs, has colors and textures intermediate between those of the A and C horizons. The C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 or 3. It has faint to prominent dark yellowish brown to reddish brown mottles in the lower part. It is typically sand that has strata of fine sand, coarse sand, or gravelly coarse sand 1 to 3 inches thick, but the range includes loamy sand and loamy fine sand and some pedons have thin strata of loamy material.

Dunn Series

The Dunn series consists of deep, moderately well drained soils that formed in sandy eolian material overlying loamy sediments on uplands. These soils are rapidly permeable in the upper part and moderately slowly permeable in the lower part. Slopes range from 0 to 20 percent.

Dunn soils are commonly near Hersh, Josburg, and Valentine soils. Hersh and Valentine soils do not have a mollic epipedon and have more sand in the underlying material than the Dunn soils. They are higher on the landscape than the Dunn soils. Josburg soils have more clay in the upper part of the profile than the Dunn soils and are in similar positions on the landscape.

Typical pedon of Dunn loamy fine sand, 0 to 3 percent slopes, 500 feet west and 700 feet south of the northeast corner of sec. 27, T. 22 N., R. 21 W.

Ap—0 to 7 inches; gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; medium acid; abrupt smooth boundary.

A—7 to 14 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; medium acid; clear smooth boundary.

AC—14 to 19 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; medium acid; clear smooth boundary.

C—19 to 28 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; few fine and medium faint yellowish brown (10YR 5/6 moist) mottles; single grain; loose; slightly acid; abrupt smooth boundary.

2Bwb—28 to 40 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (10YR 5/2) moist; common fine and medium prominent yellowish brown (10YR 5/6 moist) mottles; moderate medium subangular blocky structure; very hard, friable; sandy material in cracks and cleavages; slightly acid; gradual smooth boundary.

2C′—40 to 60 inches; light gray (2.5Y 7/2) loam, light brownish gray (2.5Y 6/2) moist; common medium prominent strong brown (7.5YR 5/8 moist) mottles; massive; hard, friable; slightly acid.

Depth to the 2Bwb horizon ranges from 20 to 37 inches. Dark sandy material is in the cracks and cleavages in the 2Bwb horizon and in the upper part of the 2C′ horizon.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is loamy fine sand or loamy sand. The AC and C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. They are sand, fine sand, loamy sand, or loamy fine sand. The 2Bwb and 2C′ horizons have hue of 7.5YR to 5Y, value of 5 to 8 (3 to 6 moist), and chroma of 2 to 4. They are typically loam, but the range includes sandy clay loam, fine sandy loam, and sandy loam.

Els Series

The Els series consists of deep, somewhat poorly drained, rapidly permeable soils that formed in sandy

eolian and alluvial material in sandhill valleys. Slopes range from 0 to 2 percent.

Els soils are commonly near Ipage, Marlake, Tryon, and Valentine soils. Ipage and Valentine soils are better drained than the Els soils and are higher on the landscape. Marlake and Tryon soils are poorly drained and very poorly drained and are lower on the landscape than the Els soils.

Typical pedon of Els loamy sand, in an area of Els-Ipage complex, 0 to 3 percent slopes, 2,500 feet north and 50 feet east of the southwest corner of sec. 15, T. 24 N., R. 22 W.

A—0 to 7 inches; dark gray (10YR 4/1) loamy sand, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

AC—7 to 14 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear smooth boundary.

C1—14 to 18 inches; very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; single grain; loose; neutral; gradual smooth boundary.

C2—18 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; common fine and medium distinct yellowish brown (10YR 5/6 moist) and dark yellowish brown (10YR 4/6 moist) mottles; single grain; loose; neutral.

The A horizon has value of 4 or 5 and chroma of 1 or 2. It is typically loamy sand, but the range includes loamy fine sand and fine sand. This horizon ranges from 6 to 9 inches in thickness. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 1 to 3. It is typically fine sand but in some pedons is loamy sand or loamy fine sand. The C horizon has hue of 10YR or 2.5Y and value of 6 to 8 (5 to 7 moist). It has mottles that are typically brownish yellow, yellowish brown, or dark yellowish brown. This horizon is typically fine sand, but in some pedons it is sand or loamy sand or has dark strata of loamy fine sand or sand. In a few places gravelly sand is below a depth of 40 inches.

Gates Series

The Gates series consists of deep, well drained and excessively drained, moderately permeable soils that formed in loamy material on uplands. Slopes range from 0 to 60 percent.

Gates soils are near Hersh and Valentine soils. Hersh soils have more sand throughout the profile than the Gates soils and are in similar positions on the landscape. Valentine soils are sandy and are on dunes.

Typical pedon of Gates very fine sandy loam, in an area of Gates-Hersh complex, 20 to 60 percent slopes, 900 feet west and 300 feet north of the southeast corner of sec. 34, T. 21 N., R. 21 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

AC—6 to 11 inches; pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable; mildly alkaline; clear smooth boundary.

C1—11 to 15 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure; soft, very friable; mildly alkaline; clear smooth boundary.

C2—15 to 60 inches; very pale brown (10YR 8/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 7 to 22 inches. The depth to carbonates ranges from 12 to 36 inches.

The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 to 3. It is typically very fine sandy loam, but the range includes silt loam and fine sandy loam. This horizon ranges from 3 to 6 inches in thickness. The AC and C horizons have hue of 10YR or 2.5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4. They are dominantly very fine sandy loam or silt loam. Thin horizons of loamy very fine sand may occur in some pedons. In the C horizon, carbonate accumulations are common and some pedons have iron stains.

Hersh Series

The Hersh series consists of deep, well drained and excessively drained, moderately rapidly permeable soils that formed in sandy and loamy eolian material on uplands (fig. 22). Slopes range from 0 to 60 percent.

Hersh soils are near Gates and Valentine soils. Gates soils have less sand in the profile than the Hersh soils and are in similar positions on the landscape. Valentine soils are sandy and are on dunes.

Typical pedon of Hersh fine sandy loam, in an area of Gates-Hersh complex, 20 to 60 percent slopes, 1,700 feet north and 100 feet east of the southwest corner of sec. 35, T. 21 N., R. 21 W.

A—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

AC—10 to 14 inches; light brownish gray (10YR 6/2)

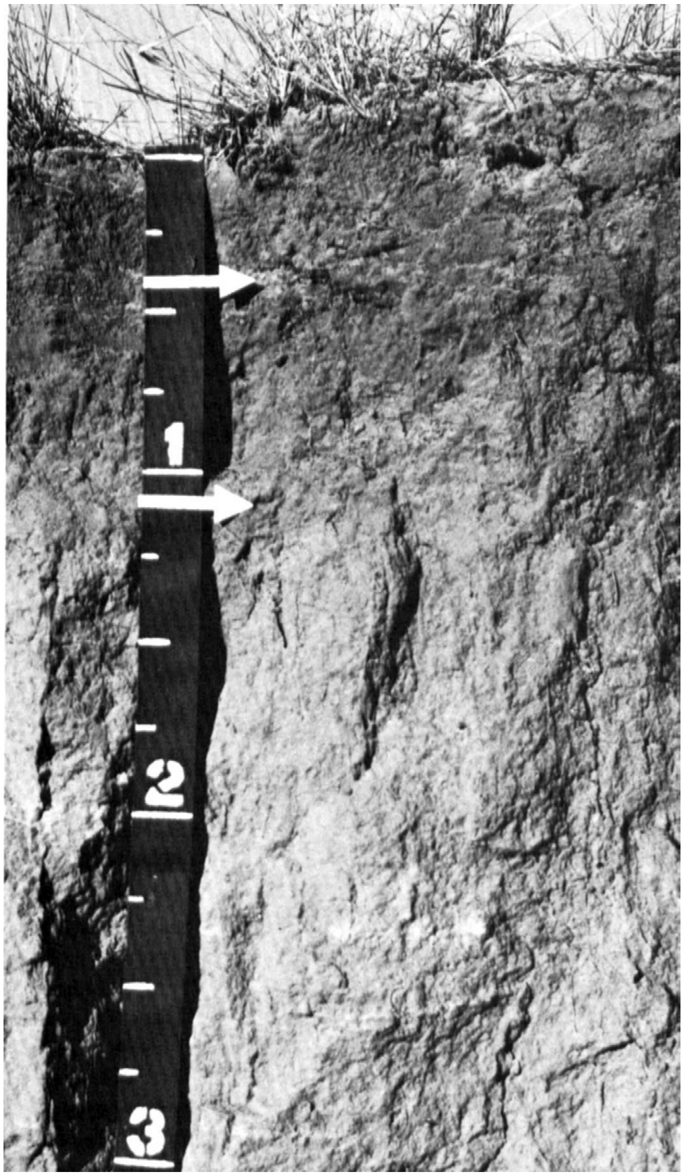

Figure 22.—Profile of a Hersh fine sandy loam. The arrows indicate the boundaries between horizons. Depth is marked in feet.

fine sandy loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

C—14 to 60 inches; light gray (10YR 7/2) loamy very fine sand, grayish brown (10YR 5/2) moist; massive; soft, very friable; neutral.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is typically fine sandy loam or loamy fine sand, but the range includes very fine sandy loam. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is fine sandy loam or loamy very fine sand. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is fine sandy loam or loamy very fine sand. Some pedons have loamy fine sand below a depth of 30 inches.

Ipage Series

The Ipage series consists of deep, moderately well drained, rapidly permeable soils that formed in sandy eolian and alluvial material in sandhill valleys and on stream terraces. Slopes range from 0 to 3 percent.

Ipage soils are commonly near Calamus, Els, Tryon, and Valentine soils. Calamus soils are stratified and are on bottom land. Els soils are somewhat poorly drained and are lower on the landscape than the Ipage soils. Tryon soils are poorly drained and very poorly drained and are on the lowest part of the landscape. Valentine soils do not have mottles within a depth of 40 inches and are higher on the landscape than the Ipage soils.

Typical pedon of Ipage fine sand, 0 to 3 percent slopes, 2,600 feet west and 1,300 feet north of the southeast corner of sec. 18, T. 23 N., R. 23 W.

A—0 to 6 inches; grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

AC—6 to 15 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear smooth boundary.

C1—15 to 34 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grain; loose; few krotovinas; neutral; clear smooth boundary.

C2—34 to 60 inches; very pale brown (10YR 7/3) fine sand, dark yellowish brown (10YR 4/6) moist; common prominent dark reddish brown (5YR 3/4 moist) mottles; single grain; loose; neutral.

The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 1 or 2. It is typically fine sand or loamy fine sand, but the range includes sand and loamy sand. It is 3 to 10 inches thick. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is typically loamy sand or fine sand, but the range includes sand and loamy fine sand. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 2 or 3. It has few or common, faint to prominent, yellowish brown or dark reddish brown mottles within a depth of 40 inches. This horizon is typically sand, fine sand, loamy sand, or loamy fine sand. Strata of coarse sand are below a depth of 30 inches in pedons on the stream terraces.

Jansen Series

The Jansen series consists of well drained soils that formed in sandy and loamy material overlying gravelly coarse sand on stream terraces. Permeability is moderate in the solum and rapid or very rapid in the underlying material. Slopes range from 0 to 3 percent.

Jansen soils are commonly adjacent to Sandose, Valentine, and Vetal soils. Sandose soils are sandy to a depth of more than 20 inches and are in landscape positions similar to those of the Jansen soils. Valentine soils are sandy throughout and are higher on the landscape than the Jansen soils. Vetal soils contain less clay than the Jansen soils and are in similar positions on the landscape.

Typical pedon of Jansen loamy fine sand, 0 to 3 percent slopes, 1,800 feet south and 100 feet east of the northwest corner of sec. 7, T. 24 N., R. 25 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

A—6 to 16 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium and fine granular; soft, very friable; slightly acid; clear smooth boundary.

Bt1—16 to 24 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate medium and fine subangular blocky structure; slightly hard, friable; slightly acid; clear smooth boundary.

Bt2—24 to 28 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium and fine subangular blocky structure; slightly hard, friable; slightly acid; clear smooth boundary.

BC—28 to 34 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; soft, very friable; slightly acid; clear smooth boundary.

C1—34 to 38 inches; very pale brown (10YR 8/3) fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable; neutral; clear smooth boundary.

2C2—38 to 60 inches; white (10YR 8/2) gravelly coarse sand, light gray (10YR 7/2) moist; single grain; loose; neutral.

The thickness of the solum and the depth to gravelly coarse sand or coarse sand range from 20 to 36 inches. The mollic epipedon ranges from 10 to 20 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loamy fine sand, but the range includes loamy sand and fine sandy loam. The Bt horizon has value of 4 or 5 (2 to 4 moist) and chroma of 1 to 4. It is typically loam, but the range includes sandy clay loam. This horizon ranges from 18 to 27 percent clay. The C and 2C horizons have value of 5 to 8 (4 to 7 moist) and chroma of 2 to 4. The C horizon is fine sandy loam, sandy loam, or loamy fine sand. The 2C horizon is coarse sand or gravelly coarse sand.

Josburg Series

The Josburg series consists of deep, moderately well drained, moderately slowly permeable soils that formed in loamy sediments on uplands. Slopes range from 0 to 9 percent.

The Josburg soils in Blaine County do not have the mollic epipedon that is typical for the series, and they have a thinner solum and contain less clay in the control section. These differences, however, do not significantly affect the use or management of the soils.

Josburg soils are near Dunn, Ipage, and Valentine soils. Dunn soils are sandy in the upper part and are in landscape positions similar to those of the Josburg soils. Ipage soils are sandy and are lower on the landscape than the Josburg soils. Valentine soils are sandy throughout and are excessively drained. They are on dunes.

Typical pedon of Josburg loamy fine sand, in an area of Josburg-Dunn loamy fine sands, 0 to 3 percent slopes, 1,200 feet east and 100 feet south of the northwest corner of sec. 9, T. 21 N., R. 23 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

2Bw—7 to 18 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; moderate coarse prismatic structure parting to moderate medium angular blocky; hard, firm; dark sandy material in cracks; slightly acid; clear smooth boundary.

2C1—18 to 25 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; massive; hard, friable; dark sandy material in cracks; moderately alkaline; clear smooth boundary.

2C2—25 to 36 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable; moderately alkaline; clear smooth boundary.

2C3—36 to 55 inches; white (10YR 8/1) fine sandy loam, light gray (10YR 7/1) moist; many medium and coarse prominent yellowish brown (10YR 5/6 moist) iron stains; massive; slightly hard, very friable; few strata of loamy sand; slightly acid; gradual smooth boundary.

2C4—55 to 60 inches; white (10YR 8/2) fine sandy loam, light gray (10YR 7/1) moist; many medium and coarse prominent yellowish brown (10YR 5/6 moist) iron stains; massive; slightly hard, friable; slightly acid.

The thickness of the solum ranges from 12 to 30 inches. Carbonates are typically below a depth of 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. It is typically loamy fine sand, but the range includes loamy sand, sandy loam, and fine sandy loam. The 2Bw horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6 (4 or 5 moist), and chroma of 2 to 4. It is typically loam, but the range includes sandy clay loam and sandy loam. The 2C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 4. It is sandy clay loam, fine sandy loam, or loam. Strata of loamy sand are common below a depth of 40 inches in some pedons.

Marlake Series

The Marlake series consists of deep, very poorly drained, rapidly permeable soils that formed in sandy alluvium. These soils are in depressions or basins in sandhill valleys and in low areas bordering lakes. Because of a high water table, they are covered with water most of the growing season. Slopes range from 0 to 2 percent.

Marlake soils are adjacent to Els, Ipage, and Tryon soils. Els and Ipage soils are better drained than the Marlake soils and are higher on the landscape. Tryon soils are also higher on the landscape than the Marlake soils and are not stratified.

Typical pedon of Marlake loamy fine sand, 0 to 2 percent slopes, 1,300 feet east and 1,600 feet north of the southwest corner of sec. 12, T. 24 N., R. 23 W.

A—0 to 6 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; few thin strata of lighter colored fine sand; neutral; clear smooth boundary.

AC—6 to 11 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; common fine distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; few thin strata of fine sandy loam and loamy fine sand; neutral; gradual smooth boundary.

C—11 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; common fine distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; few thin strata of fine sandy loam and loamy fine sand; neutral.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loamy fine sand, but the range includes loamy sand and fine sandy loam. This horizon ranges from 6 to 10 inches in thickness. The surface is covered by a layer of decayed leaves and stems 1 to 3 inches thick. The AC horizon has value of 3 to 7 (2 to 6 moist) and chroma of 1 to 3. It is dominantly fine sand or loamy fine sand but is stratified or mixed with coarse sand to fine sandy loam. The C horizon has hue of 10YR to 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3. It has few or common, faint to prominent, yellowish brown to reddish brown mottles. This horizon is dominantly sand, fine sand, loamy sand, or loamy fine sand but commonly has strata of finer or coarser material and dark buried layers. In a few pedons it has carbonate accumulations in the upper part.

Meadin Series

The Meadin series consists of excessively drained soils that formed in sandy material overlying gravelly coarse sand on the breaks of stream terraces along the North Loup River. These soils are rapidly permeable in the upper part and very rapidly permeable in the lower part. Slopes range from 3 to 30 percent.

The Meadin soils in Blaine County do not have the mollic epipedon that is typical for the series. This difference, however, does not significantly affect the use or management of the soils.

Meadin soils are commonly near Dunn, Josburg, Simeon, and Valentine soils. Dunn and Josburg soils are loamy in the lower part and are moderately well drained. They are higher on the landscape than the Meadin soils. The Simeon soils contain less than 15 percent gravel and are in landscape positions similar to those of the Meadin soils. Valentine soils are sandy throughout and are higher on the landscape than the Meadin soils.

Typical pedon of Meadin loamy sand, 3 to 30 percent slopes, 2,600 feet south and 100 feet west of the northeast corner of sec. 5, T. 22 N., R. 21 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) loamy sand, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; about 3 percent gravel, by volume; neutral; clear smooth boundary.

AC—4 to 8 inches; brown (10YR 5/3) coarse sand, dark brown (10YR 4/3) moist; single grain; loose; about 13 percent gravel, by volume; neutral; clear smooth boundary.

2C1—8 to 16 inches; light yellowish brown (10YR 6/4) gravelly coarse sand, yellowish brown (10YR 5/4) moist; single grain; loose; about 16 percent gravel, by volume; neutral; gradual smooth boundary.
2C2—16 to 60 inches; very pale brown (10YR 7/3) gravelly coarse sand, pale brown (10YR 6/3) moist; single grain; loose; about 31 percent gravel, by volume; neutral.

The depth to gravelly coarse sand ranges from 8 to 20 inches. The control section ranges from 15 to 35 percent gravel, by volume.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loamy sand, but the range includes loam and sandy loam. The AC horizon has hue of 10YR or 7.5YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. It is typically coarse sand or sand, but the range includes loamy sand to gravelly sandy loam. The A and AC horizons typically contain less than 15 percent gravel, by volume. The 2C horizon has hue of 10YR or 7.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is dominantly coarse sand, gravelly coarse sand, or very gravelly coarse sand but has strata of sand in some pedons. This horizon contains as much as 50 percent gravel, by volume, in some pedons.

Sandose Series

The Sandose series consists of deep, well drained soils that formed in sandy eolian material overlying loamy material. These soils are on uplands and stream terraces. They are rapidly permeable in the upper part and moderately permeable in the lower part. Slopes range from 0 to 3 percent.

Sandose soils are commonly near Jansen, Valentine, and Vetal soils. Jansen and Vetal soils are loamy in the upper part and are lower on the landscape than the Sandose soils. Valentine soils are sandy throughout and are on dunes.

Typical pedon of Sandose loamy fine sand, 0 to 3 percent slopes, 700 feet east and 250 feet north of the southwest corner of sec. 8, T. 24 N., R. 25 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.
A—7 to 13 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; slightly acid; clear smooth boundary.
Bw1—13 to 22 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grain; loose; slightly acid; abrupt smooth boundary.
2Bw2—22 to 30 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure; soft, very friable; neutral; clear smooth boundary.
2BC—30 to 38 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; soft, very friable; neutral; clear smooth boundary.
2C—38 to 60 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; neutral.

The thickness of the mollic epipedon ranges from 10 to 20 inches. Depth to the 2Bw horizon ranges from 20 to 36 inches. The depth to carbonates is typically more than 40 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. It is typically loamy fine sand, but the range includes loamy sand. The Bw horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is sand, fine sand, loamy sand, or loamy fine sand. The 2Bw horizon has hue of 10YR or 2.5Y, value of 4 to 7 (3 to 5 moist), and chroma of 2 to 4. It is very fine sandy loam or loam. The 2C horizon has hue of 10YR or 2.5Y, value of 6 or 7 (4 to 6 moist), and chroma of 2 to 4. It is very fine sandy loam or loam.

The Sandose soil in the map unit Valentine-Sandose loamy fine sands, 0 to 9 percent slopes, does not have the mollic epipedon that is typical for the series. This difference, however, does not significantly affect the use or behavior of the soil.

Simeon Series

The Simeon series consists of deep, excessively drained, rapidly permeable soils that formed in sandy alluvium on stream terraces. Slopes range from 0 to 30 percent.

Simeon soils are commonly near Ipage and Valentine soils. Ipage soils are moderately well drained and are lower on the landscape than the Simeon soils. Valentine soils have less than 35 percent sand and coarse sand. They are on dunes.

Typical pedon of Simeon sand, 0 to 3 percent slopes 1,900 feet south and 100 feet east of the northwest corner of sec. 23, T. 24 N., R. 25 W.

A—0 to 5 inches; grayish brown (10YR 5/2) sand, very dark grayish brown (10YR 3/2) moist; single grain; loose; slightly acid; clear smooth boundary.
AC—5 to 14 inches; light brownish gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear smooth boundary.

C1—14 to 22 inches; very pale brown (10YR 7/3) coarse sand, brown (10YR 5/3) moist; single grain; loose; about 5 percent gravel, by volume; neutral; clear smooth boundary.

C2—22 to 60 inches; white (10YR 8/2) coarse sand, light brownish gray (10YR 6/2) moist; single grain; loose; about 7 percent gravel, by volume; neutral.

The A horizon has value of 4 to 6 (2 to 5 moist) and chroma of 1 or 2. It is typically sand, but the range includes fine sand, loamy sand, and sandy loam. The AC horizon has value of 4 to 7 (4 to 6 moist) and chroma of 2 or 3. It has textures similar to those of the C horizon. The C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 to 4. It is dominantly sand, loamy sand that is more than 35 percent medium and coarse sand, or coarse sand. In some pedons it has thin strata of gravelly coarse sand. It may have as much as 15 percent gravel, by volume.

Tryon Series

The Tryon series consists of deep, poorly drained and very poorly drained, rapidly permeable soils that formed in sandy eolian and alluvial material in sandhill valleys (fig. 23). Slopes range from 0 to 2 percent.

Tryon soils are commonly near Els, Ipage, Marlake, and Valentine soils. Els and Ipage soils are higher on the landscape than the Tryon soils and are better drained. Marlake soils are lower on the landscape than the Tryon soils and are wet for longer periods of time. Valentine soils are on the steeper dunes and are excessively drained.

Typical pedon of Tryon loamy fine sand, 0 to 2 percent slopes, 1,000 feet south and 250 feet east of the northwest corner of sec. 8, T. 23 N., R. 23 W.

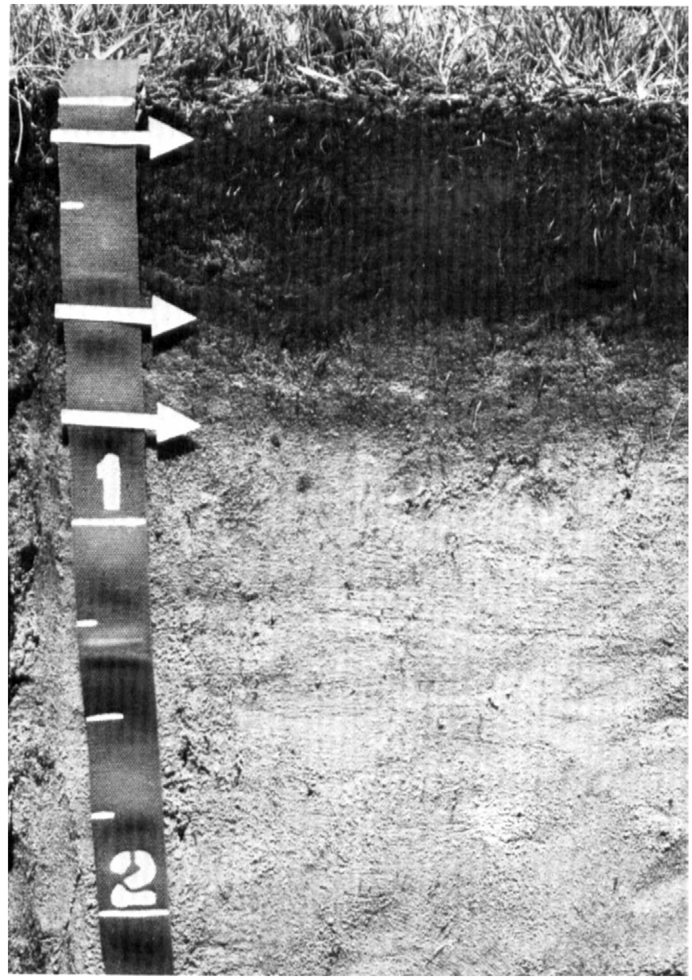

Figure 23.—Profile of a Tryon loamy fine sand. The arrows indicate the boundaries between horizons. Depth is marked in feet.

A—0 to 5 inches; very dark gray (10YR 3/1) loamy fine sand, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

AC—5 to 8 inches; gray (10YR 5/1) fine sand, dark gray (10YR 4/1) moist; common medium and fine distinct very dark gray (N 4/0 moist) mottles; single grain; loose; neutral; clear smooth boundary.

C—8 to 60 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; many medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; neutral.

These soils typically do not have free carbonates, except for the upper few inches in some pedons.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loamy fine sand and less commonly fine sand or loamy sand. It is 3 to 9 inches thick. The AC horizon has value of 5 to 7 (4 or 5 moist) and chroma of 1 or 2. It is sand, fine sand, loamy fine sand, or loamy sand. Some pedons do not have an AC horizon. The C horizon has hue of 10YR or 2.5Y, value of 5 to 8 (4 to 7 moist), and chroma of 1 to 3. It has few to many, fine to coarse, distinct or prominent mottles. It is dominantly fine sand, loamy sand, or sand but in some pedons has strata of loamy material below a depth of 40 inches.

Valentine Series

The Valentine series consists of deep, excessively drained, rapidly permeable soils that formed in sandy eolian material on uplands (fig. 24). Slopes range from 0 to 60 percent.

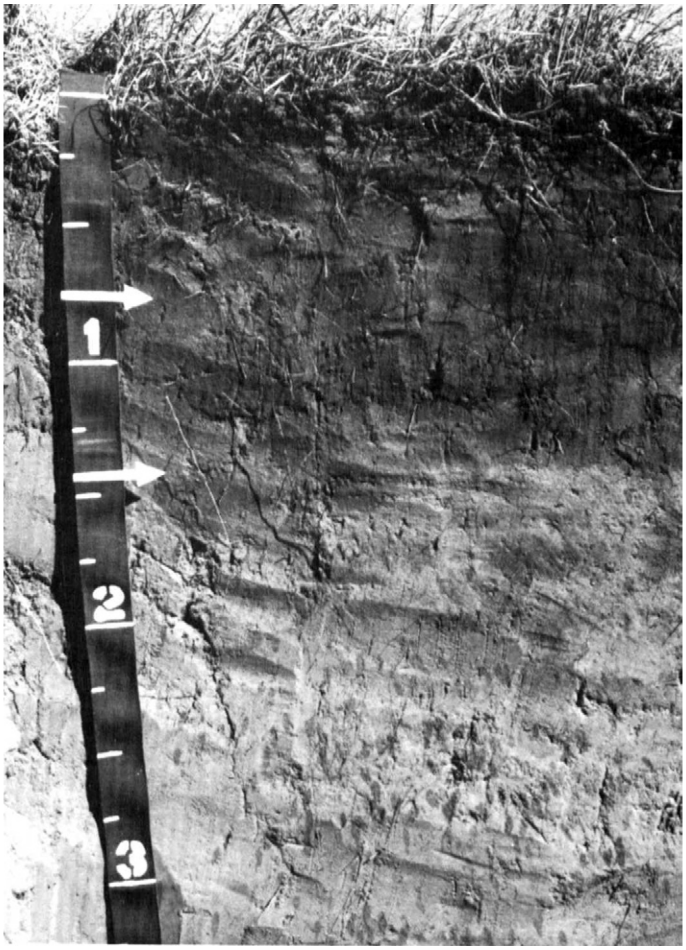

Figure 24.—Profile of a Valentine fine sand. The arrows indicate the boundaries between horizons. Depth is marked in feet.

Valentine soils are near Els, Gates, Hersh, Ipage, and Simeon soils. The adjacent soils are lower on the landscape than the Valentine soils. Els soils are somewhat poorly drained. Gates and Hersh soils have less sand than the Valentine soils. Ipage soils are moderately well drained. Simeon soils have more than 35 percent medium and coarse sand in the control section.

Typical pedon of Valentine fine sand, rolling, 1,700 feet north and 300 feet west of the southeast corner of sec. 9, T. 22 N., R. 22 W.

A—0 to 5 inches; grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; single grain; loose; slightly acid; clear smooth boundary.

AC—5 to 11 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear smooth boundary.

C1—11 to 25 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain; loose; neutral; clear smooth boundary.

C2—25 to 60 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grain; loose; neutral.

These soils are typically fine sand or loamy fine sand, but the range includes sand and loamy sand having less than 35 percent medium and coarse sand.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It ranges from 2 to 9 inches in thickness. The AC horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. Some pedons do not have an AC horizon. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 to 4.

Vetal Series

The Vetal series consists of deep, well drained, moderately rapidly permeable soils that formed in loamy and sandy alluvium on stream terraces. Slopes range from 0 to 6 percent.

Vetal soils are commonly near Jansen, Sandose, and Valentine soils. Jansen soils have more clay in the subsoil than the Vetal soils and are in similar positions on the landscape. Sandose soils have sandy material overlying loamy material that is below a depth of 20 inches. They are in positions on the landscape similar to those of the Vetal soils. Valentine soils do not have a mollic epipedon, have more sand than the Vetal soils, and are higher on the landscape.

Typical pedon of Vetal very fine sandy loam, 0 to 2 percent slopes, 2,200 feet east and 100 feet south of the northwest corner of sec. 16, T. 24 N., R. 25 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

A—7 to 22 inches; dark gray (10YR 4/1) very fine sandy loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure; soft, very friable; slightly acid; clear smooth boundary.

AC—22 to 27 inches; light gray (10YR 6/1) very fine sandy loam, dark gray (10YR 4/1) moist; weak coarse prismatic structure; slightly hard, very friable; violent effervescence; mildly alkaline; clear smooth boundary.

C1—27 to 36 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to single grain; soft, very friable; slight effervescence;

moderately alkaline; clear smooth boundary.

C2—36 to 60 inches; light gray (10YR 7/2) sand, grayish brown (10YR 5/2) moist; single grain; loose; moderately alkaline.

The depth to carbonates typically ranges from 15 to 40 inches, but a few pedons are noncalcareous to a depth of 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is loam, very fine sandy loam, fine sandy loam, or loamy fine sand. The AC horizon has value of 4 or 5 (3 or 4 moist) and chroma of 1 or 2. It is fine sandy loam, very fine sandy loam, or loam. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, loamy fine sand, fine sand, or sand but in some pedons has strata of finer or coarser material.

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life are the active factors of soil formation. They act on the parent material that has accumulated and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It is largely responsible for the chemical and mineralogical composition of the soil. The soils in Blaine County formed in sandy eolian material, in loess, and in alluvium.

The majority of the soils in the county formed in sandy eolian material. More than 50 percent of the sandy material is fine sand. The content of coarse sand or particles as fine as silt is as much as 10 percent only in a few areas. The mineralogy of the sand is mixed. Quartz and feldspar are the dominant minerals. Weathering of the sandy material is very slow, and most of the soils are not well developed. Wind action has shifted the material, forming rolling and hilly dunes, especially in areas of the Valentine soils. In the swales and valleys between the sandhills, the content of silt and clay is slightly higher than is typical on the hills and dunes. Ipage and Hersh are the main soils in the dry valleys. Elsmere, Els, and Tryon are the main soils in the wet valleys.

The soils in the southeastern part of the county formed in mixed loess and sandy material. The loess was reworked and redeposited during the period when the sandhills were formed. The resulting parent material is loamy and sandy eolian material that has a high content of very fine sand. It ranges from silt loam to fine sandy loam and has strata of sand. Soils that formed in this material are not well developed. Hersh and Gates soils formed in loamy and sandy material. Scattered dunes are throughout this area, and some areas are highly dissected.

The alluvium in the county is water-deposited material on bottom land and stream terraces along the North Loup, Middle Loup, and Dismal Rivers and their tributaries. It contains varying amounts of sand, silt, clay, and gravel. The soils that formed in alluvium do not show significant evidence of profile development. They are highly stratified and are excessively drained to very poorly drained. Some areas are subject to flooding. Almeria, Bolent, and Calamus soils formed in sandy alluvium on bottom land. Ipage and Simeon soils formed in sandy alluvium on stream terraces.

Climate

Blaine County has a subhumid, continental climate characterized by wide seasonal variations in temperature and precipitation. The mean annual temperature is about 49 degrees, and the average annual rainfall is about 21 inches. The average growing season is about 150 days.

Climate indirectly affects soil formation through its effect on the kind and amount of vegetation, micro-organisms, and animal life on and in the soil. As the plants and animals decompose, they add organic matter and plant nutrients to the soil.

Rainfall, temperature, and wind directly affect soil formation. Rainfall moves through the soil, dissolving some of the minerals and leaching nutrients, lime, and soluble salts downward. It also breaks down and moves the soil material. It has dissected the hills in the

southeast corner of the county. Alternating periods of freezing and thawing and of wetting and drying accelerate the mechanical weathering of the parent material. They also improve the physical condition of the soil by loosening and mixing the material. Wind action moves the soil material from place to place. It formed the sandhills that cover most of the county.

Plant and Animal Life

Plants and animals living in or on the soil affect the physical and chemical properties of the soil. The kinds and amounts of plants and animals are determined by the other soil-forming factors.

Mid and tall grasses are the main native plants in Blaine County. As they die, organic matter is added to the soil. The deep, fibrous root system of the grasses improves the porosity and structure of the soil. Improved porosity increases the activity of bacteria and of earthworms and other burrowing animals. The deep roots transport minerals and plant nutrients to the surface, thus improving fertility. As the plants and animals decompose, humus is added to the soil and plant nutrients are released.

Some bacteria in the soil can take nitrogen from the air. After the bacteria die, the nitrogen is available to plants. Various micro-organisms decompose plant material and dead animals, forming organic matter, which darkens the surface layer. Earthworms, cicadas, and other burrowing animals help to mix the soil material, increasing the pore space. In the wetter soils, which tend to be cooler than the drier soils, the activity of micro-organisms and animals is less extensive. As a result, the organic matter is broken down more slowly.

Relief

Relief influences soil formation through its effect on runoff, drainage, and erosion. It controls the movement of water on the surface. The degree of slope, the shape of the surface, and other features of relief affect each soil. Relief influences the moisture content in the soil and the extent of erosion on the surface.

Steep soils have a thin surface layer and indistinct horizons. Runoff is rapid on these soils. Only a small amount of water enters the soils. As a result, plants grow slowly and soil formation proceeds slowly. If runoff is excessive, erosion removes the surface layer almost as soon as the layer forms.

In the sandhills, little or no runoff occurs because of a rapid rate of water intake. The soils are excessively drained and have indistinct horizons. The sandy material is highly resistant to chemical weathering.

The nearly level and gently sloping soils generally have horizons that are more distinct than those in similar soils on the steeper slopes. The less sloping soils absorb more moisture and are affected by percolation to a greater depth. The nearly level soils in low areas receive extra moisture. As a result, these soils have a thick, dark surface layer. Also, they are leached of lime to a greater depth than other soils. As the slope increases, the thickness of the soil profile generally decreases.

Soils on bottom land and stream terraces are characterized by very low relief. Some of the soils on bottom land have a seasonal high water table, which affects the decomposition of organic matter, the soil temperature, and the degree of alkalinity. Other soils on bottom land are subject to flooding and thus to a periodic deposition of sediment.

Time

Long periods of time are needed for the formation of a soil. The resistance of the parent material to weathering and the length of time that the parent material has been in place are the main factors that determine the extent of profile development. Soils that have been in place for long periods generally have well developed horizons. Mature soils have reached an equilibrium with their environment. If the land use or other factors change, then the soils change to establish a new equilibrium.

Soils in the sandhills and on bottom land in Blaine County do not have well developed horizons. Their parent material has not been in place long enough for a mature soil to form. The sandy material in the sandhills is very resistant to weathering. As a result, the rate of soil formation is slow. Because the sandy material is not very stable, soil blowing can remove soil material from one place and deposit it in another. When this process takes place, a new cycle of soil formation begins. Another cycle of soil formation begins when floodwater on bottom land deposits new material over older parent material. Valentine, Almeria, and Bolent soils are some of the youngest soils in Blaine County.

The loamy soils on the stream terraces and uplands have been in place long enough for the formation of genetic horizons. They are not as resistant to weathering as the sandy eolian material and are not subject to flooding.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit month. The amount of forage or feed required to carry one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Boot stage. The time in the growth of grasses when the flowering head is in the upper sheaf, just prior to emergence.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Carrying capacity. The maximum stocking rate that can be used without damaging the vegetation or related resources.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root

channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly

below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay .

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled

by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Organic matter content. The amount of organic matter in soil material. The classes used in this survey are very low, less than 0.5 percent; low, 0.5 to 1.0 percent; moderately low, 1.0 to 2.0 percent; moderate, 2.0 to 4.0 percent; and high, 4.0 to 8.0 percent.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches

Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Planned grazing system. A system in which two or more units of grazing land are alternately rested and grazed in a planned sequence over a period of years.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. The removal of not more than 50 percent, by weight, of the key management plants when an area of range or pasture is grazed. Proper grazing use protects the surface by maintaining an adequate plant cover. It also maintains or improves the quality and quantity of desirable vegetation.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar

in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the classes of slope are:

Nearly level	0 to 1 percent, 0 to 2 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 6 percent
Undulating	3 to 9 percent
Strongly sloping	6 to 11 percent
Rolling	9 to 24 percent
Moderately steep	11 to 17 percent
Hilly	more than 24 percent
Very steep	30 to 60 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stocking rate. The number of livestock per unit of grazing land.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff

so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-84 at Purdum, Nebraska)

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average daily	Temperature: 2 years in 10 will have-- Maximum temperature higher than--	Temperature: 2 years in 10 will have-- Minimum temperature lower than--	Temperature: Average number of growing degree days*	Precipitation: Average	Precipitation: 2 years in 10 will have-- Less than--	Precipitation: 2 years in 10 will have-- More than--	Precipitation: Average number of days with 0.10 inch or more	Precipitation: Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	34.9	9.3	22.1	64	7	0	0.43	0.11	0.65	2	3.9
February----	41.0	14.7	27.9	73	7	9	.73	.10	1.17	2	4.5
March-------	48.0	21.6	34.8	80	7	21	1.24	.35	1.94	3	7.8
April-------	61.8	33.3	47.6	89	11	77	2.22	.99	3.23	5	2.9
May---------	72.6	44.3	58.5	94	24	273	3.51	1.67	5.00	6	.1
June--------	82.7	54.3	68.5	101	36	555	3.46	1.57	4.97	7	.0
July--------	88.7	59.9	74.3	103	44	753	2.95	1.19	4.43	5	.0
August------	86.9	58.0	72.5	102	41	698	2.52	1.07	3.74	5	.0
September---	78.0	47.4	62.7	98	26	381	1.62	.39	2.54	4	.0
October-----	67.0	35.7	51.4	91	15	124	1.06	.31	1.67	3	1.0
November----	49.8	22.7	36.3	79	15	6	.77	.13	1.24	2	4.5
December----	38.7	13.2	26.0	68	15	8	.56	.14	.83	2	5.8
Yearly:											
Average----	62.5	34.5	48.6	---	---	---	---	---	---	---	---
Extreme----	---	---	---	104	15	---	---	---	---	---	---
Total------	---	---	---	---	---	2,905	21.07	16.44	25.98	46	30.5

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and substracting the temperature below which growth is minimal for the principal crops in the areas (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-84 at Purdum, Nebraska)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 5	May 18	May 24
2 years in 10 later than--	Apr. 30	May 13	May 20
5 years in 10 later than--	Apr. 21	May 4	May 12
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 2	Sept. 22	Sept. 11
2 years in 10 earlier than--	Oct. 7	Sept. 27	Sept. 16
5 years in 10 earlier than--	Oct. 16	Oct. 7	Sept. 26

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-84 at Purdum, Nebraska)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	159	132	117
8 years in 10	165	140	124
5 years in 10	177	155	136
2 years in 10	189	170	148
1 year in 10	195	178	154

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ab	Almeria loamy fine sand, 0 to 2 percent slopes	1,850	0.4
Ac	Almeria loamy fine sand, wet, 0 to 2 percent slopes	1,740	0.4
Ad	Almeria loamy fine sand, channeled	1,180	0.3
Bg	Blownout land-Valentine complex, 6 to 60 percent slopes	1,230	0.3
Bo	Bolent loamy sand, 0 to 2 percent slopes	1,300	0.3
Cm	Calamus loamy sand, 0 to 2 percent slopes	1,740	0.4
DxB	Dunn loamy fine sand, 0 to 3 percent slopes	580	0.1
DxF	Dunn loamy fine sand, 9 to 20 percent slopes	630	0.1
DzD	Dunn-Josburg loamy fine sands, 3 to 9 percent slopes	1,870	0.4
Eb	Els loamy sand, 0 to 2 percent slopes	2,110	0.5
EfB	Els-Ipage complex, 0 to 3 percent slopes	16,350	3.6
Fu	Fluvaquents, sandy	2,230	0.5
GfC	Gates very fine sandy loam, 3 to 6 percent slopes	360	0.1
GhG	Gates-Hersh complex, 20 to 60 percent slopes	1,040	0.2
HeC	Hersh loamy fine sand, 3 to 6 percent slopes	290	0.1
HfB	Hersh-Gates complex, 0 to 3 percent slopes	2,040	0.4
IfB	Ipage fine sand, 0 to 3 percent slopes	23,660	5.2
IgB	Ipage loamy fine sand, 0 to 3 percent slopes	610	0.1
IhB	Ipage sand, terrace, 0 to 3 percent slopes	4,050	0.9
ImB	Ipage loamy fine sand, terrace, 0 to 3 percent slopes	950	0.2
ItB	Ipage-Tryon complex, 0 to 3 percent slopes	5,910	1.3
JnB	Jansen loamy fine sand, 0 to 3 percent slopes	310	0.1
JrB	Josburg-Dunn loamy fine sands, 0 to 3 percent slopes	1,230	0.3
Ma	Marlake loamy fine sand, 0 to 2 percent slopes	300	0.1
MeF	Meadin loamy sand, 3 to 30 percent slopes	260	0.1
SdB	Sandose loamy fine sand, 0 to 3 percent slopes	1,760	0.4
SmB	Simeon sand, 0 to 3 percent slopes	4,600	1.0
SmF	Simeon sand, 3 to 30 percent slopes	620	0.1
To	Tryon loamy fine sand, 0 to 2 percent slopes	1,200	0.3
Tp	Tryon loamy fine sand, wet, 0 to 2 percent slopes	660	0.1
Ts	Tryon-Els loamy fine sands, 0 to 2 percent slopes	4,670	1.0
VaD	Valentine fine sand, 3 to 9 percent slopes	35,600	7.7
VaE	Valentine fine sand, rolling	133,620	29.1
VaF	Valentine fine sand, rolling and hilly	179,550	39.1
VeB	Valentine loamy fine sand, 0 to 3 percent slopes	820	0.2
VeD	Valentine loamy fine sand, 3 to 9 percent slopes	4,810	1.0
VmD	Valentine-Els complex, 0 to 9 percent slopes	8,760	1.9
VoD	Valentine-Sandose loamy fine sands, 0 to 9 percent slopes	2,100	0.5
VsD	Valentine-Simeon complex, 0 to 9 percent slopes	950	0.2
VuC	Vetal loamy fine sand, 3 to 6 percent slopes	210	*
Vv	Vetal very fine sandy loam, 0 to 2 percent slopes	1,681	0.4
	Water	2,700	0.6
	Total	458,131	100.0

* Less than 0.1 percent.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability		Corn		Alfalfa hay	
	N	I	N	I	N	I
			Bu	Bu	Tons	Tons
Ab, Ac-------- Almeria	Vw	---	---	---	---	---
Ad------------ Almeria	VIw	---	---	---	---	---
Bg------------ Blownout land-Valentine	VIIe	---	---	---	---	---
Bo------------ Bolent	IVw	IVw	29	110	2.0	4.0
Cm------------ Calamus	VIe	IVe	---	85	---	3.2
DxB----------- Dunn	IVe	IIIe	32	125	1.6	4.8
DxF----------- Dunn	VIe	---	---	---	---	---
DzD----------- Dunn-Josburg	VIe	IVe	---	113	---	4.2
Eb------------ Els	IVw	IVw	30	110	2.0	4.0
EfB----------- Els-Ipage	VIe	IVe	---	105	---	3.9
Fu------------ Fluvaquents	VIIIw	---	---	---	---	---
GfC----------- Gates	IIIe	IIIe	34	120	2.0	5.0
GhG----------- Gates-Hersh	VIIe	---	---	---	---	---
HeC----------- Hersh	IVe	IVe	28	110	1.8	4.1
HfB----------- Hersh-Gates	IIIe	IIe	37	120	2.1	4.5
IfB----------- Ipage	VIe	IVe	---	105	---	3.7
IgB----------- Ipage	IVe	IVe	27	120	1.2	4.5

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability N	Land capability I	Corn N	Corn I	Alfalfa hay N	Alfalfa hay I
			Bu	Bu	Tons	Tons
IhB----------- Ipage	VIe	IVe	---	100	---	3.5
ImB----------- Ipage	IVe	IVe	25	120	1.2	4.1
ItB----------- Ipage-Tryon	VIe	---	---	---	---	---
JnB----------- Jansen	IVe	IIIe	33	125	1.7	5.0
JrB----------- Josburg-Dunn	IIIe	IIIe	35	130	2.0	5.0
Ma------------ Marlake	VIIIw	---	---	---	---	---
MeF----------- Meadin	VIs	---	---	---	---	---
SdB----------- Sandose	IIIe	IIIe	33	125	2.0	5.0
SmB----------- Simeon	VIs	IVs	---	100	---	3.0
SmF----------- Simeon	VIs	---	---	---	---	---
To, Tp-------- Tryon	Vw	---	---	---	---	---
Ts------------ Tryon-Els	Vw	---	---	---	---	---
VaD----------- Valentine	VIe	IVe	---	90	---	3.0
VaE----------- Valentine	VIe	---	---	---	---	---
VaF----------- Valentine-Valentine	VIIe	---	---	---	---	---
VeB----------- Valentine	IVe	IVe	25	120	1.0	3.6
VeD----------- Valentine	VIe	IVe	---	110	---	3.3
VmD----------- Valentine-Els	VIe	IVe	---	105	---	3.0
VoD----------- Valentine-Sandose	VIe	IVe	---	110	---	3.9
VsD----------- Valentine-Simeon	VIe	IVe	---	95	---	3.0

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Alfalfa hay	
	N	I	N	I	N	I
			Bu	Bu	Tons	Tons
VuC----------- Vetal	IVe	IVe	33	120	1.9	4.5
Vv------------ Vetal	IIc	I	50	145	3.5	6.2

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

(Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass) Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	---	---	---	---	---
II	1,681	---	---	---	1,681
III	5,390	5,390	---	---	---
IV	7,180	3,770	3,410	---	---
V	10,120	---	10,120	---	---
VI	246,710	240,050	1,180	5,480	---
VII	181,820	181,820	---	---	---
VIII	2,530	---	2,530	---	---

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ab: Almeria	Wet Subirrigated	Favorable	5,700	Prairie cordgrass	25
		Normal	5,200	Switchgrass	20
		Unfavorable	4,700	Big bluestem	20
				Reedgrass	15
				Sedge	10
Ac: Almeria	Wetland	Favorable	5,800	Prairie cordgrass	30
		Normal	5,400	Northern reedgrass	15
		Unfavorable	5,000	Sedge	15
				Bluejoint reedgrass	15
				Rush	10
				Slender wheatgrass	5
Bg*: Blowout land.					
Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5
Bo: Bolent	Subirrigated	Favorable	5,500	Big bluestem	30
		Normal	5,000	Indiangrass	15
		Unfavorable	4,200	Little bluestem	15
				Prairie cordgrass	10
				Switchgrass	10
				Sedge	5
Cm: Calamus	Sandy	Favorable	2,600	Sand bluestem	30
		Normal	2,200	Little bluestem	20
		Unfavorable	1,600	Prairie sandreed	15
				Switchgrass	10
				Needleandthread	10
				Sedge	5
				Indiangrass	5
DxB: Dunn	Sandy Lowland	Favorable	3,500	Big bluestem	15
		Normal	3,200	Needleandthread	15
		Unfavorable	3,000	Switchgrass	10
				Little bluestem	10
				Prairie sandreed	10
				Blue grama	5
				Purple lovegrass	5
				Kentucky bluegrass	5
				Prairie junegrass	5
				Indiangrass	5
				Sedge	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
DxF: Dunn	Sandy	Favorable	3,500	Sand bluestem	30
		Normal	3,200	Little bluestem	25
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Switchgrass	5
				Blue grama	5
DzD*:					
Dunn	Sandy Lowland	Favorable	3,500	Sand bluestem	30
		Normal	3,200	Little bluestem	25
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Switchgrass	5
				Blue grama	5
Josburg	Sandy	Favorable	3,500	Sand bluestem	25
		Normal	3,300	Little bluestem	20
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Blue grama	5
				Sedge	5
Eb: Els	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	25
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	5
				Sedge	5
EfB*:					
Els	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	25
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	5
				Sedge	5
Ipage	Sandy Lowland	Favorable	3,500	Sand bluestem	25
		Normal	3,200	Little bluestem	20
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Indiangrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5
GfC: Gates	Silty	Favorable	3,700	Big bluestem	30
		Normal	3,200	Little bluestem	15
		Unfavorable	2,700	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Blue grama	5
				Needleandthread	5
				Sedge	5
				Leadplant	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Compo- sition
			Lb/acre		Pct
GhG*:					
Gates	Silty	Favorable	3,700	Big bluestem	30
		Normal	3,200	Little bluestem	15
		Unfavorable	2,700	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Blue grama	5
				Needleandthread	5
				Sedge	5
				Leadplant	5
Hersh	Sandy	Favorable	3,500	Sand bluestem	30
		Normal	3,300	Little bluestem	25
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Blue grama	5
				Switchgrass	5
HeC Hersh	Sandy	Favorable	3,500	Sand bluestem	30
		Normal	3,300	Little bluestem	25
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Blue grama	5
				Switchgrass	5
HfB*:					
Hersh	Sandy	Favorable	3,500	Sand bluestem	30
		Normal	3,300	Little bluestem	25
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Blue grama	5
				Switchgrass	5
Gates	Silty	Favorable	3,700	Big bluestem	30
		Normal	3,200	Little bluestem	15
		Unfavorable	2,700	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Blue grama	5
				Needleandthread	5
				Sedge	5
				Leadplant	5
IfB, IgB Ipage	Sandy Lowland	Favorable	3,500	Sand bluestem	25
		Normal	3,200	Little bluestem	20
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Indiangrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
IhB, ImB: Ipage	Sandy	Favorable	3,000	Prairie sandreed	20
		Normal	2,600	Sand bluestem	15
		Unfavorable	2,500	Little bluestem	10
				Switchgrass	10
				Needleandthread	10
				Blue grama	5
				Sedge	5
				Indiangrass	5
ItB*:					
Ipage	Sandy Lowland	Favorable	3,500	Sand bluestem	25
		Normal	3,200	Little bluestem	20
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Indiangrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5
Tryon	Wetland	Favorable	6,000	Prairie cordgrass	25
		Normal	5,800	Northern reedgrass	20
		Unfavorable	5,500	Bluejoint reedgrass	15
				Rush	5
				Slender wheatgrass	5
JnB: Jansen	Sandy	Favorable	3,500	Little bluestem	25
		Normal	3,300	Sand bluestem	15
		Unfavorable	3,000	Blue grama	10
				Sand dropseed	10
				Needleandthread	10
				Prairie sandreed	10
				Sedge	5
				Purple lovegrass	5
				Western wheatgrass	5
JrB*:					
Josburg	Sandy	Favorable	3,500	Sand bluestem	25
		Normal	3,300	Little bluestem	20
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Blue grama	5
				Sedge	5
Dunn	Sandy Lowland	Favorable	3,500	Big bluestem	15
		Normal	3,200	Needleandthread	15
		Unfavorable	3,000	Switchgrass	10
				Little bluestem	10
				Prairie sandreed	10
				Blue grama	5
				Purple lovegrass	5
				Kentucky bluegrass	5
				Prairie junegrass	5
				Indiangrass	5
				Sedge	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
MeF---------------- Meadin	Shallow to Gravel-------------	Favorable	1,500	Blue grama--------------------	25
		Normal	1,300	Clubmoss----------------------	15
		Unfavorable	1,100	Needleandthread---------------	15
				Prairie sandreed--------------	10
				Fringed sagebrush-------------	10
				Sand bluestem-----------------	5
				Hairy grama-------------------	5
				Sand dropseed-----------------	5
SdB---------------- Sandose	Sandy-------------------------	Favorable	3,500	Little bluestem---------------	20
		Normal	3,300	Prairie sandreed--------------	20
		Unfavorable	3,000	Needleandthread---------------	15
				Blue grama--------------------	10
				Sand bluestem-----------------	5
				Sedge-------------------------	5
SmB---------------- Simeon	Shallow to Gravel-------------	Favorable	1,500	Blue grama--------------------	20
		Normal	1,300	Prairie sandreed--------------	15
		Unfavorable	800	Needleandthread---------------	15
				Sand bluestem-----------------	10
				Little bluestem---------------	10
				Clubmoss----------------------	10
				Hairy grama-------------------	5
				Sand dropseed-----------------	5
SmF---------------- Simeon	Shallow to Gravel-------------	Favorable	1,400	Blue grama--------------------	20
		Normal	1,200	Prairie sandreed--------------	15
		Unfavorable	700	Needleandthread---------------	15
				Sand bluestem-----------------	10
				Little bluestem---------------	10
				Clubmoss----------------------	10
				Hairy grama-------------------	5
				Sand dropseed-----------------	5
To----------------- Tryon	Wet Subirrigated--------------	Favorable	5,800	Switchgrass-------------------	20
		Normal	5,500	Indiangrass-------------------	15
		Unfavorable	5,300	Big bluestem------------------	15
				Prairie cordgrass-------------	10
				Slender wheatgrass------------	5
				Plains bluegrass--------------	5
Tp----------------- Tryon	Wetland-----------------------	Favorable	6,000	Prairie cordgrass-------------	25
		Normal	5,800	Northern reedgrass------------	20
		Unfavorable	5,500	Bluejoint reedgrass-----------	15
				Rush--------------------------	5
				Slender wheatgrass------------	5
Ts*:					
Tryon-------------	Wet Subirrigated--------------	Favorable	5,800	Switchgrass-------------------	20
		Normal	5,500	Indiangrass-------------------	15
		Unfavorable	5,300	Big bluestem------------------	15
				Prairie cordgrass-------------	10
				Slender wheatgrass------------	5
				Plains bluegrass--------------	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ts*:					
Els	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	25
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	5
				Sedge	5
VaD, VaE	Sands	Favorable	3,000	Sand bluestem	25
Valentine		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5
VaF*:					
Valentine, rolling	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5
Valentine, hilly	Choppy Sands	Favorable	2,800	Sand bluestem	20
		Normal	2,400	Prairie sandreed	20
		Unfavorable	2,000	Little bluestem	15
				Switchgrass	10
				Needleandthread	10
				Sand lovegrass	5
				Blue grama	5
				Sandhill muhly	5
VeB	Sandy	Favorable	3,300	Sand bluestem	20
Valentine		Normal	3,000	Little bluestem	20
		Unfavorable	2,600	Prairie sandreed	20
				Needleandthread	15
				Blue grama	10
				Switchgrass	5
				Sand dropseed	5
VeD	Sands	Favorable	3,000	Sand bluestem	25
Valentine		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5
VmD*:					
Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
VmD*:					
Els	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	25
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	5
				Sedge	5
VoD*:					
Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5
Sandose	Sandy	Favorable	3,500	Little bluestem	20
		Normal	3,300	Prairie sandreed	20
		Unfavorable	3,000	Needleandthread	15
				Blue grama	10
				Sand bluestem	5
				Sedge	5
VsD*:					
Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	20
				Switchgrass	10
				Sand lovegrass	5
				Blue grama	5
				Needleandthread	5
Simeon	Shallow to Gravel	Favorable	1,500	Blue grama	20
		Normal	1,300	Prairie sandreed	15
		Unfavorable	800	Needleandthread	15
				Sand bluestem	10
				Little bluestem	10
				Clubmoss	10
				Hairy grama	5
				Sand dropseed	5
VuC Vetal	Sandy	Favorable	2,000	Needleandthread	25
		Normal	1,500	Blue grama	25
		Unfavorable	800	Threadleaf sedge	15
				Prairie sandreed	10
				Western wheatgrass	10
				Sand dropseed	5
Vv Vetal	Silty	Favorable	3,500	Little bluestem	25
		Normal	2,800	Needleandthread	10
		Unfavorable	2,000	Prairie sandreed	10
				Blue grama	10
				Sideoats grama	10
				Big bluestem	10
				Switchgrass	5
				Western wheatgrass	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ab: Almeria	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Ac, Ad. Almeria					
Bg*: Blownout land.					
Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Bo: Bolent	American plum, lilac, Siberian peashrub.	Manchurian crabapple.	Eastern redcedar, ponderosa pine, hackberry, green ash.	Golden willow, honeylocust.	Eastern cottonwood.
Cm: Calamus	---	Eastern redcedar, Rocky Mountain juniper.	Scotch pine, jack pine, ponderosa pine, Austrian pine.	---	---
DxB: Dunn	Skunkbush sumac	Eastern redcedar, Russian olive, lilac, Manchurian crabapple, Siberian peashrub.	Ponderosa pine, honeylocust, green ash, hackberry.	Siberian elm	---
DxF: Dunn	---	Rocky Mountain juniper, eastern redcedar.	Austrian pine, ponderosa pine, jack pine.	---	---
DzD*: Dunn	---	Rocky Mountain juniper, eastern redcedar.	Austrian pine, ponderosa pine, jack pine.	---	---
Josburg	Lilac, skunkbush sumac.	Eastern redcedar, Siberian peashrub, Russian olive, Manchurian crabapple.	Ponderosa pine, honeylocust, green ash, hackberry.	Siberian elm	---
Eb: Els	Lilac	Common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine.	Honeylocust, golden willow, silver maple.	Eastern cottonwood.
EfB*: Els	Lilac	Common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine.	Honeylocust, golden willow, silver maple.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
EfB*:					
Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Fu. Fluvaquents					
GfC Gates	Amur honeysuckle, fragrant sumac, lilac.	Russian mulberry	Green ash, honeylocust, Russian olive, eastern redcedar, bur oak, ponderosa pine, hackberry.	Siberian elm	---
GhG*:					
Gates.					
Hersh.					
HeC Hersh	Lilac, American plum.	Common chokecherry	Eastern redcedar, honeylocust, hackberry, ponderosa pine, green ash, Russian mulberry, Scotch pine, Austrian pine.	Siberian elm	---
HfB*:					
Hersh	Lilac, American plum.	Common chokecherry	Eastern redcedar, honeylocust, hackberry, ponderosa pine, green ash, Russian mulberry, Scotch pine, Austrian pine.	Siberian elm	---
Gates	Amur honeysuckle, fragrant sumac, lilac.	Russian mulberry	Green ash, honeylocust, Russian olive, eastern redcedar, bur oak, ponderosa pine, hackberry.	Siberian elm	---
IfB Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
IgB Ipage	Lilac, skunkbush sumac.	Eastern redcedar, Siberian peashrub, Manchurian crabapple, Russian olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
IhB: Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, jack pine, Scotch pine, Austrian pine.	---	---
ImB: Ipage	---	Eastern redcedar, Rocky Mountain juniper, lilac, American plum, skunkbush sumac.	Austrian pine, jack pine, ponderosa pine, honeylocust, green ash, hackberry.	Siberian elm	---
ItB*:					
Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Tryon.					
JnB: Jansen	Siberian peashrub, Peking cotoneaster, lilac.	Eastern redcedar, Russian olive, ponderosa pine, Manchurian crabapple, Rocky Mountain juniper, bur oak.	Green ash, Siberian elm, honeylocust.	---	---
JrB*:					
Josburg	Lilac, skunkbush sumac.	Eastern redcedar, Siberian peashrub, Russian olive, Manchurian crabapple.	Ponderosa pine, honeylocust, green ash, hackberry.	Siberian elm	---
Dunn	Skunkbush sumac	Eastern redcedar, Russian olive, lilac, Manchurian crabapple, Siberian peashrub.	Ponderosa pine, honeylocust, green ash, hackberry.	Siberian elm	---
Ma. Marlake					
MeF. Meadin					
SdB: Sandose	Lilac, skunkbush sumac.	Eastern redcedar, Russian olive, Manchurian crabapple, Siberian peashrub.	Hackberry, ponderosa pine, green ash, honeylocust.	Siberian elm	---
SmB, SmF. Simeon					
To: Tryon	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Tp. Tryon					
Ts*: Tryon	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Els	Lilac	Common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine.	Honeylocust, golden willow, silver maple.	Eastern cottonwood.
VaD, VaE Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
VaF*: Valentine, rolling.					
Valentine, hilly.					
VeB Valentine	Lilac, skunkbush sumac.	Eastern redcedar, Russian olive, Manchurian crabapple, Siberian peashrub.	Hackberry, ponderosa pine, green ash, honeylocust.	Siberian elm	---
VeD Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
VmD*: Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Els	Lilac	Common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine.	Honeylocust, golden willow, silver maple.	Eastern cottonwood.
VoD*: Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Sandose	Lilac, skunkbush sumac.	Eastern redcedar, Russian olive, Manchurian crabapple, Siberian peashrub.	Hackberry, ponderosa pine, green ash, honeylocust.	Siberian elm	---
VsD*: Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
VsD*: Simeon.					
VuC-------------- Vetal	Skunkbush sumac, common chokecherry, American plum, lilac.	Siberian peashrub	Honeylocust, Austrian pine, green ash, ponderosa pine, Rocky Mountain juniper, eastern redcedar.	Siberian elm------	---
Vv--------------- Vetal	Lilac------------	Eastern redcedar, Rocky Mountain juniper, common chokecherry, Russian olive, Siberian peashrub.	Hackberry, ponderosa pine, honeylocust, green ash.	Siberian elm------	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ab------------------- Almeria	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ac------------------- Almeria	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.
Ad------------------- Almeria	Severe: flooding, ponding.	Severe: ponding.		Severe: ponding.
Bg*: Blownout land.				
Valentine------------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Bo------------------- Bolent	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.
Cm------------------- Calamus	Severe: flooding.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
DxB------------------ Dunn	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy.
DxF------------------ Dunn	Moderate: slope, wetness, too sandy.	Moderate: slope, wetness, too sandy.	Severe: slope.	Moderate: wetness, too sandy.
DzD*:				
Dunn-----------------	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Severe: slope.	Moderate: wetness, too sandy.
Josburg--------------	Slight---------------	Slight---------------	Severe: slope.	Slight.
Eb------------------- Els	Severe: flooding.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy.
EfB*:				
Els------------------	Severe: flooding.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy.
Ipage----------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Fu: Fluvaquents	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.
GfC: Gates	Slight	Slight	Moderate: slope.	Severe: erodes easily.
GhG*:				
Gates	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
Hersh	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HeC: Hersh	Slight	Slight	Moderate: slope.	Slight.
HfB*:				
Hersh	Slight	Slight	Slight	Slight.
Gates	Slight	Slight	Slight	Severe: erodes easily.
IfB: Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
IgB: Ipage	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
IhB: Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
ImB: Ipage	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
ItB*:				
Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Tryon	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
JnB: Jansen	Slight	Slight	Slight	Slight.
JrB*:				
Josburg	Slight	Slight	Slight	Slight.
Dunn	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy.
Ma: Marlake	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MeF: Meadin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SdB: Sandose	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
SmB: Simeon	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
SmF: Simeon	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
To: Tryon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Tp: Tryon	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Ts*:				
Tryon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Els	Severe: flooding.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy.
VaD: Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VaE: Valentine	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VaF*:				
Valentine, rolling	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Valentine, hilly	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
VeB: Valentine	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
VeD: Valentine	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
VmD*:				
Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Els	Severe: flooding.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
VoD*:				
Valentine	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
Sandose	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
VsD*:				
Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Simeon	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
VuC Vetal	Slight	Slight	Moderate: slope.	Slight.
Vv Vetal	Slight	Slight	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ab------------------ Almeria	Poor	Fair	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Ac, Ad-------------- Almeria	Very poor.	Poor	Fair	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	Poor.
Bg*: Blownout land.												
Valentine----------	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Bo------------------ Bolent	Poor	Fair	Good	Good	Good	Good	Fair	Very poor.	Fair	Good	Poor	Good.
Cm------------------ Calamus	Poor	Good	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Fair.
DxB----------------- Dunn	Fair	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
DxF----------------- Dunn	Poor	Fair	Good	Good	Good	Good	Poor	Poor	Fair	Good	Poor	Good.
DzD*: Dunn--------------	Fair	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Josburg------------	Poor	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
Eb------------------ Els	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
EfB*: Els----------------	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
Ipage--------------	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Fu------------------ Fluvaquents	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
GfC----------------- Gates	Fair	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
GhG*: Gates--------------	Poor	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Hersh--------------	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.
HeC----------------- Hersh	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
HfB*:												
Hersh	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Gates	Good	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
IfB, IgB Ipage	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
IhB Ipage	Fair	Good	Fair	Fair	Good	Fair	Poor	Poor	Fair	---	Poor	Good.
ImB Ipage	Poor	Good	Fair	Poor	Fair	Fair	Poor	Poor	Fair	---	Poor	Good.
ItB*:												
Ipage	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Tryon	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
JnB Jansen	Poor	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Fair.
JrB*:												
Josburg	Fair	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Dunn	Fair	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Ma Marlake	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
MeF Meadin	Very poor.	Poor	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
SdB Sandose	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
SmB Simeon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
SmF Simeon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
To, Tp Tryon	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Ts*:												
Tryon	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Els	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
VaD, VaE Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VaF*:												
Valentine, rolling	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
VaF*:												
Valentine, hilly	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VeB: Valentine	Fair	Good	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VeD: Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VmD*:												
Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Els	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
VoD*:												
Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Sandose	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
VsD*:												
Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Simeon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VuC: Vetal	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.	Fair.
Vv: Vetal	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ab: Almeria	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness.
Ac: Almeria	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding.
Ad: Almeria	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding, flooding.
Bg*: Blownout land.						
Valentine	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bo: Bolent	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: wetness, droughty, flooding.
Cm: Calamus	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: droughty.
DxB: Dunn	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness, shrink-swell.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
DxF: Dunn	Severe: cutbanks cave, wetness.	Moderate: wetness, slope.	Severe: wetness, shrink-swell.	Severe: slope.	Moderate: wetness, slope, frost action.	Moderate: wetness, droughty, slope.
DzD*: Dunn	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness, shrink-swell.	Moderate: wetness, slope.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Josburg	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Eb: Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
EfB*: Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
EfB*:						
Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.
Fu Fluvaquents	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding, flooding.
GfC Gates	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
GhG*:						
Gates	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hersh	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HeC Hersh	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
HfB*:						
Hersh	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
Gates	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
IfB, IgB, IhB, ImB Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.
ItB*:						
Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.
Tryon	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.
JnB Jansen	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.	Moderate: droughty.
JrB*:						
Josburg	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Dunn	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness, shrink-swell.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Ma Marlake	Severe: cutbanks cave, wetness.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MeF Meadin	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
SdB: Sandose	Severe: cutbanks cave.	Slight	Moderate: shrink-swell.	Slight	Slight	Slight.
SmB: Simeon	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
SmF: Simeon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
To: Tryon	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
Tp: Tryon	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.
Ts*:						
Tryon	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
VaD: Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VaE: Valentine	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VaF*:						
Valentine, rolling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Valentine, hilly	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VeB: Valentine	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
VeD: Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VmD*:						
Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
VoD*:						
Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Sandose	Severe: cutbanks cave.	Slight	Moderate: shrink-swell.	Slight	Slight	Slight.
VsD*:						
Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Simeon	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
VuC Vetal	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Vv Vetal	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ab: Almeria	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Ac, Ad: Almeria	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, ponding.
Bg*: Blownout land.					
Valentine	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Bo: Bolent	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
Cm: Calamus	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
DxB: Dunn	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage.	Fair: too clayey, wetness.
DxF: Dunn	Severe: wetness, percs slowly, poor filter.	Severe: seepage, slope, wetness.	Severe: wetness.	Severe: seepage.	Fair: too clayey, slope, wetness.
DzD*: Dunn	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage.	Fair: too clayey, wetness.
Josburg	Severe: percs slowly.	Severe: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Eb: Els	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
EfB*:					
Els	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Fu Fluvaquents	Severe: flooding, ponding.	Severe: seepage, flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, seepage, ponding.	Poor: ponding.
GfC Gates	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too sandy.	Slight	Good.
GhG*:					
Gates	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Hersh	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
HeC Hersh	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
HfB*:					
Hersh	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Gates	Moderate: percs slowly.	Moderate: seepage.	Moderate: too sandy.	Slight	Good.
IfB, IgB Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
IhB, ImB Ipage	Severe: wetness, poor filter.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
ItB*:					
Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Tryon	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
JnB Jansen	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
JrB*:					
Josburg	Severe: percs slowly.	Severe: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Dunn	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage.	Fair: too clayey, wetness.
Ma Marlake	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
MeF Meadin	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
SdB Sandose	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
SmB Simeon	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
SmF Simeon	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
To Tryon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Tp Tryon	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Ts*:					
Tryon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Els	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
VaD Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
VaE------------------ Valentine	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
VaF*:					
Valentine, rolling-	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Valentine, hilly---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
VeB, VeD------------ Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VmD*:					
Valentine----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Els----------------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
VoD*:					
Valentine----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Sandose------------	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
VsD*:					
Valentine----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Simeon-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VuC, Vv------------- Vetal	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ab, Ac, Ad: Almeria	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Bg*: Blownout land.				
Valentine	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Bo: Bolent	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Cm: Calamus	Good	Probable	Probable	Poor: too sandy.
DxB, DxF: Dunn	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
DzD*: Dunn	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Josburg	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Eb: Els	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
EfB*: Els	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Ipage	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Fu: Fluvaquents	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
GfC: Gates	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
GhG*: Gates	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Hersh	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HeC------------------- Hersh	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
HfB*:				
Hersh----------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Gates----------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
IfB, IgB, IhB, ImB---- Ipage	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
ItB*:				
Ipage----------------	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
Tryon----------------	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: small stones, wetness.
JnB------------------ Jansen	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: area reclaim.
JrB*:				
Josburg--------------	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Dunn-----------------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Ma------------------- Marlake	Poor: wetness.	Probable-------------	Improbable----------- too sandy.	Poor: too sandy, wetness.
MeF------------------ Meadin	Fair: slope.	Probable-------------	Probable-------------	Poor: too sandy, small stones, area reclaim.
SdB------------------ Sandose	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
SmB------------------ Simeon	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
SmF------------------ Simeon	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
To------------------- Tryon	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: too sandy, small stones, wetness.
Tp------------------- Tryon	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: small stones, wetness.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ts*:				
Tryon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, wetness.
Els	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
VaD Valentine	Good	Probable	Improbable: too sandy.	Poor: too sandy.
VaE Valentine	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
VaF*:				
Valentine, rolling	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Valentine, hilly	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
VeB, VeD Valentine	Good	Probable	Improbable: too sandy.	Poor: too sandy.
VmD*:				
Valentine	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Els	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
VoD*:				
Valentine	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Sandose	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
VsD*:				
Valentine	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Simeon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
VuC, Vv Vetal	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "moderate" and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
Ab----------------- Almeria	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy.	Wetness, droughty, rooting depth.
Ac, Ad------------- Almeria	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, flooding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy.	Wetness, droughty, rooting depth.
Bg*: Blownout land.						
Valentine---------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Bo----------------- Bolent	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
Cm----------------- Calamus	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
DxB---------------- Dunn	Severe: seepage.	Moderate: wetness.	Percs slowly---	Wetness, droughty.	Wetness, soil blowing.	Droughty, percs slowly.
DxF---------------- Dunn	Severe: seepage, slope.	Moderate: wetness.	Percs slowly, slope.	Slope, wetness, droughty.	Slope, wetness, soil blowing.	Slope, droughty, percs slowly.
DzD*: Dunn-------------	Severe: seepage.	Moderate: wetness.	Percs slowly, slope.	Slope, wetness, droughty.	Wetness, soil blowing.	Droughty, percs slowly.
Josburg----------	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope, fast intake, soil blowing.	Soil blowing, percs slowly.	Percs slowly.
Eb----------------- Els	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
EfB*: Els--------------	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
EfB*:						
Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Fu Fluvaquents	Severe: seepage.	Severe: seepage, ponding.	Ponding, flooding.	Ponding, droughty, rooting depth.	Too clayey	Wetness, droughty, rooting depth.
GfC Gates	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Erodes easily, soil blowing.	Erodes easily.
GhG*:						
Gates	Severe: slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
Hersh	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
HeC Hersh	Severe: seepage.	Severe: piping.	Deep to water	Slope, fast intake, soil blowing.	Soil blowing	Favorable.
HfB*:						
Hersh	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
Gates	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing	Erodes easily, soil blowing.	Erodes easily.
IfB, IgB, IhB, ImB Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
ItB*:						
Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Tryon	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy.	Wetness, droughty.
JnB Jansen	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
JrB*:						
Josburg	Moderate: seepage.	Moderate: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing, percs slowly.	Percs slowly.
Dunn	Severe: seepage.	Moderate: wetness.	Percs slowly	Wetness, droughty.	Wetness, soil blowing.	Droughty, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ma----------------- Marlake	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding: cutbanks cave.	Ponding: droughty, fast intake.	Ponding: too sandy,	Wetness: droughty.
MeF---------------- Meadin	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
SdB---------------- Sandose	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing---	Favorable.
SmB---------------- Simeon	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
SmF---------------- Simeon	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
To----------------- Tryon	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy.	Wetness, droughty.
Tp----------------- Tryon	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy.	Wetness, droughty.
Ts*:						
Tryon------------	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy.	Wetness, droughty.
Els--------------	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
VaD---------------- Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
VaE---------------- Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
VaF*:						
Valentine, rolling---------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Valentine, hilly-	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
VeB--------------- Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
VeD--------------- Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
VmD*:						
Valentine--------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Els--------------	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
VoD*:						
Valentine--------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Sandose----------	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing---	Favorable.
VsD*:						
Valentine--------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Simeon-----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
VuC--------------- Vetal	Severe: seepage.	Severe: piping.	Deep to water	Slope, fast intake, soil blowing.	Soil blowing---	Favorable.
Vv---------------- Vetal	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ab-------------- Almeria	0-4	Loamy fine sand	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	50-80	15-55	<20	NP-5
	4-60	Stratified sand to fine sandy loam.	SM, SP-SM, SM-SC, SP	A-2, A-3, A-4	0	90-100	80-100	50-80	0-50	<20	NP-5
Ac-------------- Almeria	0-4	Loamy fine sand	SM, SM-SC	A-2	0	100	100	50-75	15-30	<20	NP-5
	4-60	Stratified sand to fine sandy loam.	SM, SP-SM, SM-SC, SP	A-2, A-3	0	95-100	90-100	50-75	0-30	<20	NP-5
Ad-------------- Almeria	0-3	Loamy fine sand	SM, SM-SC	A-2	0	100	100	50-75	15-30	<20	NP-5
	3-60	Stratified sand to fine sandy loam.	SM, SP-SM, SM-SC, SP	A-2, A-3	0	95-100	90-100	50-75	0-30	<20	NP-5
Bg*: Blownout land.											
Valentine-------	0-4	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	4-60	Loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-35	---	NP
Bo-------------- Bolent	0-5	Loamy sand-------	SM, SP-SM	A-2, A-3	0	95-100	95-100	60-80	5-25	<20	NP
	5-60	Stratified fine sandy loam to sand.	SM, SP, SP-SM	A-2, A-3, A-1	0	85-100	80-100	40-70	3-35	---	NP
Cm-------------- Calamus	0-8	Loamy sand-------	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-80	5-35	<20	NP-5
	8-17	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	90-100	65-80	3-35	---	NP
	17-60	Stratified loamy sand to coarse sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	80-100	30-90	3-35	---	NP
DxB------------- Dunn	0-14	Loamy fine sand	SM	A-2	0	100	100	50-95	15-35	---	NP
	14-28	Loamy sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-95	5-35	---	NP
	28-60	Sandy clay loam, loam.	CL, SC	A-7, A-6	0	100	100	80-95	40-80	30-50	15-30
DxF------------- Dunn	0-12	Loamy fine sand	SM	A-2	0	100	100	50-95	15-35	---	NP
	12-28	Loamy sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-95	5-35	---	NP
	28-60	Sandy clay loam, loam.	CL, SC	A-7, A-6	0	100	100	80-95	40-80	30-50	15-30
DzD*: Dunn-----------	0-11	Loamy fine sand	SM	A-2	0	100	100	50-95	15-35	---	NP
	11-24	Loamy sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-95	5-35	---	NP
	24-60	Sandy clay loam, loam.	CL, SC	A-7, A-6	0	100	100	80-95	40-80	30-50	15-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
DzD*:											
Josburg	0-6	Loamy fine sand	SM, SP-SM	A-2	0	100	95-100	50-95	10-35	---	NP
	6-12	Loam, sandy loam, sandy clay loam.	CL, SC	A-6	0	100	95-100	65-95	35-85	25-35	10-15
	12-60	Sandy clay loam, fine sandy loam, loam.	SC, CL	A-4, A-6, A-7	0	100	90-100	70-100	35-85	25-50	8-25
Eb Els	0-7	Loamy sand	SM	A-2	0	95-100	85-100	60-100	25-35	---	NP
	7-60	Fine sand, loamy sand, sand.	SP-SM, SM, SP	A-2, A-3	0	90-100	90-100	70-100	4-30	---	NP
EfB*:											
Els	0-7	Loamy sand	SM	A-2	0	95-100	85-100	60-100	25-35	---	NP
	7-60	Fine sand, loamy sand, sand.	SP-SM, SM, SP	A-2, A-3	0	90-100	90-100	70-100	4-30	---	NP
Ipage	0-3	Fine sand	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-30	---	NP
	3-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
Fu Fluvaquents	0-60	Loamy sand	SM, SP-SM	A-2, A-3, A-4	0	100	100	50-70	5-40	<25	NP-5
	60-80	Variable	---	---	---	---	---	---	---	---	---
GfC Gates	0-7	Very fine sandy loam.	ML	A-4	0	100	100	95-100	65-100	20-40	NP-10
	7-18	Very fine sandy loam.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10
	18-60	Very fine sandy loam, silt loam, loamy very fine sand.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10
GhG*:											
Gates	0-6	Very fine sandy loam.	ML	A-4	0	100	100	95-100	65-100	20-40	NP-10
	6-11	Very fine sandy loam.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10
	11-60	Very fine sandy loam, silt loam, loamy very fine sand.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10
Hersh	0-10	Fine sandy loam	SM, SC, SM-SC, ML	A-4	0	100	100	85-100	40-75	<25	NP-10
	10-14	Fine sandy loam, loamy very fine sand, very fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	80-100	40-65	<20	NP-5
	14-60	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, SM-SC	A-4, A-2	0	100	100	80-100	25-50	<20	NP-5

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
HeC-------------- Hersh	0-6	Loamy fine sand	SM, SM-SC	A-4	0	100	100	95-100	35-50	<20	NP-5
	6-12	Fine sandy loam, loamy very fine sand, very fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	80-100	40-65	<20	NP-5
	12-60	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, SM-SC	A-4, A-2	0	100	100	80-100	25-50	<20	NP-5
HfB*:											
Hersh-----------	0-5	Fine sandy loam	SM, SC, SM-SC, ML	A-4	0	100	100	85-100	40-75	<25	NP-10
	5-10	Fine sandy loam, loamy very fine sand, very fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	80-100	40-65	<20	NP-5
	10-60	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, SM-SC	A-4, A-2	0	100	100	80-100	25-50	<20	NP-5
Gates-----------	0-5	Very fine sandy loam.	ML	A-4	0	100	100	95-100	65-100	20-40	NP-10
	5-10	Very fine sandy loam.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10
	10-60	Very fine sandy loam, silt loam, loamy very fine sand.	ML	A-4	0	100	100	95-100	85-100	20-40	NP-10
IfB-------------- Ipage	0-6	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-30	---	NP
	6-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
IgB-------------- Ipage	0-6	Loamy fine sand	SM, SP-SM	A-2	0	100	100	50-90	10-35	---	NP
	6-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
IhB-------------- Ipage	0-6	Sand-------------	SP-SM, SM	A-2, A-3	0	100	100	50-100	5-15	---	NP
	6-25	Sand, fine sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	50-100	5-30	<20	NP-5
	25-60	Coarse sand, sand, fine sand.	SP, SP-SM	A-2, A-3, A-1	0	100	95-100	25-95	2-10	---	NP
ImB-------------- Ipage	0-6	Loamy fine sand	SM, SM-SC	A-2	0	100	100	50-100	15-30	<20	NP-5
	6-25	Sand, fine sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	50-100	5-30	<20	NP-5
	25-60	Coarse sand, sand, fine sand.	SP, SP-SM	A-2, A-3, A-1	0	100	95-100	25-95	2-10	---	NP
ItB*:											
Ipage-----------	0-6	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-30	---	NP
	6-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
Tryon-----------	0-5	Loamy fine sand	SM, SP-SM	A-2	0	100	100	85-100	10-30	---	NP
	5-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	50-90	50-90	5-30	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
JnB-------------- Jansen	0-6	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	70-100	5-35	---	NP
	6-28	Loam, sandy clay loam.	CL	A-6, A-7	0	95-100	90-100	80-100	50-80	30-45	10-25
	28-38	Loamy coarse sand	SM, SP-SM	A-2, A-4, A-1	0	95-100	90-100	45-85	10-45	---	NP
	38-60	Coarse sand, sand, gravelly coarse sand.	SW, SW-SM, SP, SP-SM	A-3, A-1, A-2	0	85-100	45-100	35-65	3-10	---	NP
JrB*:											
Josburg---------	0-7	Loamy fine sand	SM, SP-SM	A-2	0	100	95-100	50-95	10-35	---	NP
	7-18	Loam, sandy loam, sandy clay loam.	CL, SC	A-6	0	100	95-100	65-95	35-85	25-35	10-15
	18-60	Sandy clay loam, fine sandy loam, loam.	SC, CL	A-4, A-6, A-7	0	100	90-100	70-100	35-85	25-50	8-25
Dunn------------	0-14	Loamy fine sand	SM	A-2	0	100	100	50-95	15-35	---	NP
	14-24	Loamy sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-95	5-35	---	NP
	24-60	Sandy clay loam, loam.	CL, SC	A-7, A-6	0	100	100	80-95	40-80	30-50	15-30
Ma--------------- Marlake	0-6	Loamy fine sand	SM	A-2, A-4	0	100	100	50-85	15-50	---	NP
	6-11	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM	A-2, A-4, A-3	0	100	100	50-85	5-50	---	NP
	11-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP
MeF-------------- Meadin	0-4	Loamy sand-------	SM	A-2, A-4, A-1	0	85-100	75-95	40-80	15-50	---	NP
	4-8	Sandy loam, very gravelly loamy sand, gravelly sandy loam.	SM, SP-SM, GM, SP-GM	A-3, A-2	0	40-80	30-70	15-50	1-10	---	NP
	8-60	Gravelly coarse sand, very gravelly coarse sand, gravelly sand.	SP-SM, SP, SP-GM, GP	A-1	0	40-80	30-70	15-50	1-10	---	NP
SdB-------------- Sandose	0-13	Loamy fine sand	SM, SM-SC	A-2	0	100	100	70-100	15-35	<20	NP-5
	13-22	Loamy fine sand, fine sand, sand.	SP-SM, SM-SC, SM	A-2, A-3	0	100	100	65-85	5-35	<20	NP-5
	22-60	Fine sandy loam, loam, very fine sandy loam.	SM, ML, CL, SC	A-4	0	100	95-100	70-95	40-75	<25	NP-10
SmB, SmF--------- Simeon	0-5	Sand-------------	SM, SP-SM	A-2, A-3	0	95-100	90-100	51-95	5-20	<20	NP
	5-60	Sand, coarse sand, loamy sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	90-100	80-100	35-95	0-30	---	NP
To--------------- Tryon	0-5	Loamy fine sand	SM, SP-SM	A-2	0	100	100	85-100	10-30	---	NP
	5-8	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	51-95	3-30	---	NP
	8-60	Fine sand, sand, loamy sand.	SP-SM, SM	A-2, A-3	0	100	100	51-95	3-30	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Tp---------------- Tryon	0-5	Loamy fine sand	SM, SP-SM	A-2	0	100	100	85-100	10-30	---	NP
	5-11	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	50-90	50-90	5-30	---	NP
	11-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-30	---	NP
Ts*:											
Tryon-----------	0-5	Loamy fine sand	SM, SP-SM	A-2	0	100	100	85-100	10-30	---	NP
	5-13	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	51-95	3-30	---	NP
	13-60	Fine sand, sand, loamy sand.	SP-SM, SM	A-2, A-3	0	100	100	51-95	3-30	---	NP
Els--------------	0-8	Loamy fine sand	SM	A-2	0	95-100	85-100	60-100	25-35	---	NP
	8-60	Fine sand, loamy sand, sand.	SP-SM, SM, SP	A-2, A-3	0	90-100	90-100	70-100	4-30	---	NP
VaD, VaE--------- Valentine	0-5	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	5-60	Loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-25	---	NP
VaF*:											
Valentine, rolling--------	0-5	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	5-60	Loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-35	---	NP
Valentine, hilly	0-4	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	4-60	Loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-35	---	NP
VeB, VeD--------- Valentine	0-6	Loamy fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-35	---	NP
	6-60	Loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-35	---	NP
VmD*:											
Valentine-------	0-5	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	5-60	Loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-35	---	NP
Els--------------	0-7	Loamy sand-------	SM	A-2	0	95-100	85-100	60-100	25-35	---	NP
	7-60	Fine sand, loamy sand, sand.	SP-SM, SM, SP	A-2, A-3	0	90-100	90-100	70-100	4-30	---	NP
VoD*:											
Valentine-------	0-6	Loamy fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-35	---	NP
	6-60	Loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-35	---	NP
Sandose---------	0-7	Loamy fine sand	SM, SM-SC	A-2	0	100	100	70-100	15-35	<20	NP-5
	7-25	Loamy fine sand, fine sand, sand.	SP-SM, SM-SC, SM	A-2, A-3	0	100	100	65-85	5-35	<20	NP-5
	25-60	Fine sandy loam, loam, very fine sandy loam.	SM, ML, CL, SC	A-4	0	100	95-100	70-95	40-75	<25	NP-10

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
VsD*:											
Valentine-------	0-6	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	6-60	Loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-35	---	NP
Simeon----------	0-5	Sand-------------	SM, SP-SM	A-2, A-3	0	95-100	90-100	51-95	5-20	<20	NP
	5-60	Sand, coarse sand, loamy sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	90-100	80-100	35-95	0-30	---	NP
VuC-------------- Vetal	0-18	Loamy fine sand	SM, SM-SC	A-2	0	100	100	85-100	15-35	<25	NP-5
	18-26	Fine sandy loam, very fine sandy loam, sandy loam.	SM, ML	A-4, A-2	0	100	100	60-95	30-65	20-30	NP-7
	26-60	Loamy fine sand, fine sand, sand.	SM, SM-SC	A-2	0	100	100	85-100	15-35	<25	NP-5
Vv--------------- Vetal	0-22	Very fine sandy loam.	CL, ML, SM, SC	A-4, A-6, A-2	0	100	100	90-100	30-55	20-35	NP-12
	22-27	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-100	30-65	20-30	NP-10
	27-60	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-100	30-65	20-30	NP-10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ab, Ac------------ Almeria	0-4	3-10	1.35-1.55	6.0-20	0.10-0.12	6.1-8.4	<4	Low--------	0.17	5	8	.5-4
	4-60	---	1.55-1.80	6.0-20	0.05-0.12	5.1-8.4	<4	Low--------	0.15			
Ad---------------- Almeria	0-3	3-10	1.35-1.55	6.0-20	0.10-0.12	6.1-8.4	<4	Low--------	0.17	5	8	.5-4
	3-60	1-10	1.55-1.80	6.0-20	0.05-0.12	6.1-8.4	<4	Low--------	0.15			
Bg*: Blownout land.												
Valentine--------	0-4	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	<2	Low--------	0.15	5	1	.5-1
	4-60	2-10	1.70-1.90	6.0-20	0.09-0.11	5.6-7.3	<2	Low--------	0.17			
Bo---------------- Bolent	0-5	3-10	1.40-1.60	6.0-20	0.10-0.12	7.4-8.4	<2	Low--------	0.17	5	2	.5-1
	5-60	1-10	1.50-1.80	6.0-20	0.05-0.10	6.6-8.4	<2	Low--------	0.15			
Cm---------------- Calamus	0-8	1-10	1.50-1.60	6.0-20	0.06-0.11	5.6-7.8	<2	Low--------	0.17	5	2	.5-1
	8-17	3-10	1.50-1.60	6.0-20	0.06-0.11	6.1-7.8	<2	Low--------	0.17			
	17-60	1-10	1.50-1.70	6.0-20	0.02-0.11	6.1-7.8	<2	Low--------	0.15			
DxB--------------- Dunn	0-14	4-12	1.35-1.55	6.0-20	0.10-0.12	5.6-7.3	<2	Low--------	0.17	5	2	1-3
	14-28	2-10	1.40-1.60	6.0-20	0.06-0.11	5.6-7.3	<2	Low--------	0.17			
	28-60	15-27	1.60-1.70	0.06-0.6	0.14-0.18	5.6-8.4	<2	High-------	0.32			
DxF--------------- Dunn	0-12	4-12	1.35-1.55	6.0-20	0.10-0.12	5.6-7.3	<2	Low--------	0.17	5	2	1-3
	12-28	2-10	1.40-1.60	6.0-20	0.06-0.11	5.6-7.3	<2	Low--------	0.17			
	28-60	15-27	1.60-1.70	0.06-0.6	0.14-0.18	5.6-8.4	<2	High-------	0.32			
DzD*: Dunn-------------	0-11	4-12	1.35-1.55	6.0-20	0.10-0.12	5.6-7.3	<2	Low--------	0.17	5	2	1-3
	11-24	2-10	1.40-1.60	6.0-20	0.06-0.11	5.6-7.3	<2	Low--------	0.17			
	24-60	15-27	1.60-1.70	0.06-0.6	0.14-0.18	5.6-8.4	<2	High-------	0.32			
Josburg----------	0-6	0-8	1.35-1.55	6.0-20	0.10-0.12	5.6-7.3	<2	Low--------	0.17	5	2	1-3
	6-12	17-28	1.40-1.70	0.2-2.0	0.12-0.19	5.1-6.5	<2	Moderate	0.32			
	12-60	15-27	1.45-1.65	0.2-0.6	0.14-0.17	6.1-8.4	<2	Moderate	0.32			
Eb---------------- Els	0-7	3-10	1.55-1.60	6.0-20	0.08-0.13	6.1-7.3	<2	Low--------	0.17	5	2	.5-2
	7-60	0-8	1.50-1.60	6.0-20	0.05-0.08	6.1-7.3	<2	Low--------	0.15			
EfB*: Els--------------	0-7	3-10	1.55-1.60	6.0-20	0.08-0.13	6.1-7.3	<2	Low--------	0.17	5	2	.5-2
	7-60	0-8	1.50-1.60	6.0-20	0.05-0.08	6.1-7.3	<2	Low--------	0.15			
Ipage------------	0-3	1-5	1.40-1.50	6.0-20	0.07-0.09	5.1-7.3	<2	Low--------	0.15	5	1	.5-1
	3-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.1-7.3	<2	Low--------	0.15			
Fu---------------- Fluvaquents	0-60	1-18	1.30-1.80	6.0-20	0.07-0.13	6.6-8.4	<2	Low--------	0.17	5	8	2-8
	60-80	---	---	---	---	---	---	-----------	----			
GfC--------------- Gates	0-7	14-17	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low--------	0.37	5	3	<1
	7-18	13-15	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.37			
	18-60	14-17	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.37			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
GhG*:												
Gates-----------	0-6	14-17	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low--------	0.37	5	3	<1
	6-11	13-15	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.37			
	11-60	14-17	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.37			
Hersh-----------	0-10	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low--------	0.24	5	3	.5-2
	10-14	8-18	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.3	<2	Low--------	0.24			
	14-60	10-18	1.20-1.50	2.0-6.0	0.10-0.16	6.6-7.8	<2	Low--------	0.24			
HeC-------------- Hersh	0-6	5-12	1.40-1.60	2.0-6.0	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2	.5-2
	6-12	8-18	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.3	<2	Low--------	0.24			
	12-60	10-18	1.20-1.50	2.0-6.0	0.10-0.16	6.6-7.8	<2	Low--------	0.24			
HfB*:												
Hersh-----------	0-5	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low--------	0.24	5	3	.5-2
	5-10	8-18	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.3	<2	Low--------	0.24			
	10-60	10-18	1.20-1.50	2.0-6.0	0.10-0.16	6.6-7.8	<2	Low--------	0.24			
Gates-----------	0-5	14-17	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low--------	0.37	5	3	<1
	5-10	13-15	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.37			
	10-60	14-17	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.37			
IfB-------------- Ipage	0-6	1-5	1.40-1.50	6.0-20	0.07-0.09	5.1-7.3	<2	Low--------	0.15	5	1	.5-1
	6-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.1-7.3	<2	Low--------	0.15			
IgB-------------- Ipage	0-6	3-10	1.40-1.50	6.0-20	0.10-0.12	5.1-7.3	<2	Low--------	0.17	5	2	.5-2
	6-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.1-7.3	<2	Low--------	0.15			
IhB-------------- Ipage	0-6	0-5	1.40-1.60	6.0-20	0.07-0.09	5.1-7.3	<2	Low--------	0.15	5	1	.5-1
	6-25	0-10	1.55-1.80	6.0-20	0.06-0.11	5.1-7.8	<2	Low--------	0.15			
	25-60	0-5	1.60-1.85	6.0-20	0.02-0.07	5.1-7.8	<2	Low--------	0.15			
ImB-------------- Ipage	0-6	3-10	1.35-1.55	6.0-20	0.10-0.12	5.1-7.3	<2	Low--------	0.17	5	2	.5-2
	6-25	0-10	1.55-1.80	6.0-20	0.06-0.11	5.1-7.8	<2	Low--------	0.15			
	25-60	0-5	1.60-1.85	6.0-20	0.02-0.07	5.1-7.8	<2	Low--------	0.15			
ItB*:												
Ipage-----------	0-6	1-5	1.40-1.50	6.0-20	0.07-0.09	5.1-7.3	<2	Low--------	0.15	5	1	.5-1
	6-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.1-7.3	<2	Low--------	0.15			
Tryon-----------	0-5	3-10	1.40-1.60	6.0-20	0.10-0.12	5.6-8.4	<2	Low--------	0.17	5	8	4-8
	5-60	1-7	1.50-1.70	6.0-20	0.06-0.08	5.6-7.8	<2	Low--------	0.17			
JnB-------------- Jansen	0-6	2-8	1.60-1.70	6.0-20	0.07-0.12	5.1-7.3	<2	Low--------	0.17	4	2	1-2
	6-28	18-32	1.10-1.25	0.6-2.0	0.15-0.19	5.1-7.3	<2	Moderate	0.32			
	28-38	2-7	1.45-1.65	6.0-20	0.06-0.11	5.1-7.3	<2	Low--------	0.10			
	38-60	0-3	1.50-1.70	>20	0.02-0.04	5.1-7.3	<2	Low--------	0.10			
JrB*:												
Josburg---------	0-7	0-8	1.35-1.55	6.0-20	0.10-0.12	5.6-7.3	<2	Low--------	0.17	5	2	1-3
	7-18	17-28	1.40-1.70	0.2-2.0	0.12-0.19	5.1-6.5	<2	Moderate	0.32			
	18-60	15-27	1.45-1.65	0.2-0.6	0.14-0.17	6.1-8.4	<2	Moderate	0.32			
Dunn------------	0-14	4-12	1.35-1.55	6.0-20	0.10-0.12	5.6-7.3	<2	Low--------	0.17	5	2	1-3
	14-24	2-10	1.40-1.60	6.0-20	0.06-0.11	5.6-7.3	<2	Low--------	0.17			
	24-60	15-27	1.60-1.70	0.06-0.6	0.14-0.18	5.6-8.4	<2	High-------	0.32			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ma---------------- Marlake	0-6	3-10	1.50-1.60	6.0-20	0.10-0.14	6.6-8.4	<2	Low--------	0.17	2	8	4-8
	6-11	3-8	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	<2	Low--------	0.17			
	11-60	0-5	1.50-1.60	6.0-20	0.05-0.07	6.6-8.4	<2	Low--------	0.17			
MeF--------------- Meadin	0-4	6-10	1.50-1.70	2.0-6.0	0.10-0.12	5.1-7.3	<2	Low--------	0.17	3	2	1-2
	4-8	5-18	1.50-1.60	6.0-20	0.09-0.11	5.1-7.3	<2	Low--------	0.10			
	8-60	2-5	1.50-1.70	>20	0.02-0.05	6.1-7.3	<2	Low--------	0.10			
SdB--------------- Sandose	0-13	0-8	1.35-1.55	6.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2	1-3
	13-22	0-8	1.55-1.70	6.0-20	0.07-0.12	6.1-7.3	<2	Low--------	0.17			
	22-60	5-20	1.45-1.70	0.6-6.0	0.16-0.19	6.6-7.8	<2	Low--------	0.32			
SmB, SmF--------- Simeon	0-5	3-10	1.30-1.50	6.0-20	0.06-0.12	6.1-7.8	<2	Low--------	0.15	5	1	.5-1
	5-60	2-10	1.50-1.70	6.0-20	0.05-0.10	6.1-7.8	<2	Low--------	0.15			
To---------------- Tryon	0-5	3-10	1.40-1.60	6.0-20	0.10-0.12	5.6-8.4	<2	Low--------	0.17	5	8	4-8
	5-8	1-7	1.50-1.70	6.0-20	0.06-0.08	5.6-7.8	<2	Low--------	0.17			
	8-60	2-7	1.50-1.70	6.0-20	0.05-0.07	5.6-7.8	<2	Low--------	0.17			
Tp---------------- Tryon	0-5	3-10	1.40-1.60	6.0-20	0.10-0.12	5.6-8.4	<2	Low--------	0.17	5	8	4-8
	5-11	1-7	1.50-1.70	6.0-20	0.06-0.08	5.6-7.8	<2	Low--------	0.17			
	11-60	2-7	1.50-1.70	6.0-20	0.05-0.07	5.6-7.8	<2	Low--------	0.17			
Ts*:												
Tryon------------	0-5	3-10	1.40-1.60	6.0-20	0.10-0.12	5.6-8.4	<2	Low--------	0.17	5	8	4-8
	5-13	1-7	1.50-1.70	6.0-20	0.06-0.08	5.6-7.8	<2	Low--------	0.17			
	13-60	2-7	1.50-1.70	6.0-20	0.05-0.07	5.6-7.8	<2	Low--------	0.17			
Els--------------	0-8	3-10	1.55-1.60	6.0-20	0.08-0.13	6.1-7.3	<2	Low--------	0.17	5	2	.5-2
	8-60	0-8	1.50-1.60	6.0-20	0.05-0.08	6.1-7.3	<2	Low--------	0.15			
VaD, VaE--------- Valentine	0-5	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	<2	Low--------	0.15	5	1	.5-1
	5-60	2-10	1.70-1.90	6.0-20	0.09-0.11	5.6-7.3	<2	Low--------	0.17			
VaF*:												
Valentine, rolling---------	0-5	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	<2	Low--------	0.15	5	1	.5-1
	5-60	2-10	1.70-1.90	6.0-20	0.09-0.11	5.6-7.3	<2	Low--------	0.17			
Valentine, hilly	0-4	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	<2	Low--------	0.15	5	1	.5-1
	4-60	2-10	1.70-1.90	6.0-20	0.09-0.11	5.6-7.3	<2	Low--------	0.17			
VeB, VeD--------- Valentine	0-6	2-10	1.70-1.90	6.0-20	0.10-0.12	5.6-7.3	<2	Low--------	0.17	5	2	.5-1
	6-60	2-10	1.70-1.90	6.0-20	0.09-0.11	5.6-7.3	<2	Low--------	0.17			
VmD*:												
Valentine--------	0-5	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	<2	Low--------	0.15	5	1	.5-1
	5-60	2-10	1.70-1.90	6.0-20	0.09-0.11	5.6-7.3	<2	Low--------	0.17			
Els--------------	0-7	3-10	1.55-1.60	6.0-20	0.08-0.13	6.1-7.3	<2	Low--------	0.17	5	2	.5-2
	7-60	0-8	1.50-1.60	6.0-20	0.05-0.08	6.1-7.3	<2	Low--------	0.15			
VoD*:												
Valentine--------	0-6	2-10	1.70-1.90	6.0-20	0.10-0.12	5.6-7.3	<2	Low--------	0.17	5	2	.5-1
	6-60	2-10	1.70-1.90	6.0-20	0.09-0.11	5.6-7.3	<2	Low--------	0.17			
Sandose----------	0-7	0-8	1.35-1.55	6.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2	1-3
	7-25	0-8	1.55-1.70	6.0-20	0.07-0.12	6.1-7.3	<2	Low--------	0.17			
	25-60	5-20	1.45-1.70	0.6-6.0	0.16-0.19	6.6-7.8	<2	Low--------	0.32			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
VsD*:												
Valentine-------	0-6	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	<2	Low--------	0.15	5	1	.5-1
	6-60	2-10	1.70-1.90	6.0-20	0.09-0.11	5.6-7.3	<2	Low--------	0.17			
Simeon----------	0-5	3-10	1.30-1.50	6.0-20	0.06-0.12	6.1-7.8	<2	Low--------	0.15	5	1	.5-1
	5-60	2-10	1.50-1.70	6.0-20	0.05-0.10	6.1-7.8	<2	Low--------	0.15			
VuC-------------- Vetal	0-18	5-10	1.25-1.35	2.0-6.0	0.10-0.12	6.6-7.8	<2	Low--------	0.20	5	2	1-3
	18-26	12-18	1.25-1.35	2.0-6.0	0.11-0.19	6.6-7.8	<2	Low--------	0.20			
	26-60	5-10	1.40-1.50	6.0-20	0.08-0.10	7.4-8.4	<2	Low--------	0.20			
Vv--------------- Vetal	0-22	10-18	1.20-1.30	2.0-6.0	0.17-0.21	5.6-7.8	<2	Low--------	0.32	5	3	1-3
	22-27	12-18	1.25-1.40	2.0-6.0	0.11-0.17	6.1-7.8	<2	Low--------	0.20			
	27-60	10-18	1.30-1.40	2.0-6.0	0.11-0.17	6.1-8.4	<2	Low--------	0.20			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Ab: Almeria	D	Occasional	Brief	Apr-Jun	0-1.5	Apparent	Nov-May	Moderate	High	Low.
Ac: Almeria	D	Occasional	Brief	Jan-Jul	+.5-1.0	Apparent	Nov-May	Moderate	High	Low.
Ad: Almeria	D	Frequent	Brief	Jan-Jul	+.5-1.0	Apparent	Nov-May	Moderate	High	Low.
Bg*:										
Blownout land.										
Valentine	A	None	---	---	>6.0	---	---	Low	Low	Low.
Bo: Bolent	A	Occasional	Brief	Mar-Jun	1.5-3.5	Apparent	Nov-May	Moderate	Low	Low.
Cm: Calamus	A	Rare	---	---	3.0-6.0	Apparent	Mar-Jun	Low	Low	Low.
DxB, DxF: Dunn	A	None	---	---	1.5-3.5	Perched	Jan-Jun	Moderate	High	Low.
DzD*:										
Dunn	A	None	---	---	1.5-3.5	Perched	Jan-Jun	Moderate	High	Low.
Josburg	C	None	---	---	3.0-6.0	Perched	Jan-Jun	Moderate	High	Low.
Eb: Els	A	Rare	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
EfB*:										
Els	A	Rare	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
Ipage	A	None	---	---	3.0-6.0	Apparent	Dec-Jun	Moderate	Low	Moderate.
Fu: Fluvaquents	D	Frequent	Brief to very long.	Nov-Jun	+2-1.0	Apparent	Jan-Dec	Moderate	High	Low.
GfC: Gates	B	None	---	---	>6.0	---	---	Moderate	Low	Low.
GhG*:										
Gates	B	None	---	---	>6.0	---	---	Moderate	Low	Low.
Hersh	B	None	---	---	>6.0	---	---	Moderate	Low	Low.
HeC: Hersh	B	None	---	---	>6.0	---	---	Moderate	Low	Low.
HfB*:										
Hersh	B	None	---	---	>6.0	---	---	Moderate	Low	Low.
Gates	B	None	---	---	>6.0	---	---	Moderate	Low	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
IfB, IgB: Ipage	A	None	---	---	3.0-6.0	Apparent	Dec-Jun	Moderate	Low	Moderate.
IhB, ImB: Ipage	A	None	---	---	3.5-6.0	Apparent	Jan-Apr	Moderate	Low	Moderate.
ItB*:										
Ipage	A	None	---	---	3.0-6.0	Apparent	Dec-Jun	Moderate	Low	Moderate.
Tryon	D	Rare	---	---	+.5-1.0	Apparent	Nov-May	Moderate	High	Low.
JnB: Jansen	B	None	---	---	>6.0	---	---	Moderate	Moderate	Low.
JrB*:										
Josburg	C	None	---	---	3.0-6.0	Perched	Jan-Jun	Moderate	High	Low.
Dunn	A	None	---	---	1.5-3.5	Perched	Jan-Jun	Moderate	High	Low.
Ma: Marlake	D	None	---	---	+2-1.0	Apparent	Oct-Jun	Moderate	High	Low.
MeF: Meadin	A	None	---	---	>6.0	---	---	Low	Low	Moderate.
SdB: Sandose	A	None	---	---	>6.0	---	---	Low	Moderate	Low.
SmB, SmF: Simeon	A	None	---	---	>6.0	---	---	Low	Low	Low.
To: Tryon	D	Rare	---	---	0-1.5	Apparent	Nov-May	Moderate	High	Low.
Tp: Tryon	D	Rare	---	---	+.5-1.0	Apparent	Nov-May	Moderate	High	Low.
Ts*:										
Tryon	D	Rare	---	---	0-1.5	Apparent	Nov-May	Moderate	High	Low.
Els	A	Rare	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
VaD, VaE: Valentine	A	None	---	---	>6.0	---	---	Low	Low	Low.
VaF*:										
Valentine, rolling	A	None	---	---	>6.0	---	---	Low	Low	Low.
Valentine, hilly	A	None	---	---	>6.0	---	---	Low	Low	Low.
VeB, VeD: Valentine	A	None	---	---	>6.0	---	---	Low	Low	Low.
VmD*:										
Valentine	A	None	---	---	>6.0	---	---	Low	Low	Low.
Els	A	Rare	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
VoD*:										
Valentine	A	None	---	---	>6.0	---	---	Low	Low	Low.
Sandose	A	None	---	---	>6.0	---	---	Low	Moderate	Low.
VsD*:										
Valentine	A	None	---	---	>6.0	---	---	Low	Low	Low.
Simeon	A	None	---	---	>6.0	---	---	Low	Low	Low.
VuC, Vv Vetal	B	None	---	---	>6.0	---	---	Moderate	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX TEST DATA

(Dashes indicate that data were not available. LL means liquid limit; PI, plasticity index; and NP, nonplastic)

Soil name,* report number, horizon, and depth in inches	Classification		Grain-size distribution**								LL	PI	Specific gravity
			Percentage passing sieve--						Percentage smaller than--				
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.002 mm			
											Pct		g/cc
Calamus loamy sand: (S84NE-9-2)													
C2----- 22 to 36	A-3(3)	SP	100	99	94	86	57	3	1	0	NP	NP	2.60
C3----- 36 to 50	A-1-b(3)	SP	100	96	89	81	44	1	0	0	NP	NP	2.63
C4----- 50 to 60	A-3(2)	SP	---	100	98	96	79	2	0	0	NP	NP	2.61
Els loamy sand: (S86NE-9-53)													
A------ 0 to 7	A-2-4(0)	---	---	---	---	100	96	22	13	4	NP	NP	2.59
C2----- 18 to 60	A-3(2)	---	---	---	---	100	98	4	3	2	NP	NP	2.64
Ipage fine sand: (S86NE-9-55													
A------ 0 to 6	A-3(2)	---	---	---	---	100	98	9	6	2	NP	NP	2.64
C1----- 15 to 34	A-3(2)	---	---	---	---	100	96	5	3	2	NP	NP	2.66
C2----- 34 to 60	A-3(2)	---	---	---	---	100	97	8	4	0	NP	NP	2.63
Josburg loamy fine sand: (S86NE-9-69)													
A------ 0 to 7	A-2-4(0)	---	---	---	---	100	96	28	17	4	NP	NP	2.58
2Bw---- 7 to 18	A-4(0)	---	---	---	---	100	97	37	23	10	NP	NP	2.62
2C3---- 36 to 55	A-4(2)	---	---	---	---	100	97	46	34	16	NP	NP	2.62
Sandose loamy fine sand: (S86NE-9-80)													
Ap----- 0 to 7	A-2-2(0)	---	---	---	---	100	95	22	11	3	NP	NP	2.60
Bw1---- 13 to 22	A-2-4(0)	---	---	---	100	99	94	27	10	3	NP	NP	2.62
2Bw2--- 22 to 30	A-4(3)	---	---	---	100	99	92	51	27	7	NP	NP	2.60
2C----- 38 to 60	A-4(5)	---	---	---	100	99	94	58	33	12	NP	NP	2.60
Simeon sand: (S86NE-9-74)													
A------ 0 to 5	A-3(2)	---	---	---	100	98	72	9	5	1	NP	NP	2.60
C1----- 14 to 22	A-3(2)	---	---	---	100	98	74	7	3	0	NP	NP	2.62
C2----- 22 to 60	A-3(2)	---	---	100	99	97	59	3	1	0	NP	NP	2.61
Tryon loamy fine sand: (S86NE-9-41)													
A------ 0 to 5	A-2-4(0)	---	---	---	---	100	94	24	18	4	NP	NP	2.53
C------ 5 to 60	A-3(2)	---	---	---	---	100	94	10	4	0	NP	NP	2.62

See footnotes at end of table.

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

Soil name,* report number, horizon, and depth in inches	Classification		Grain-size distribution**								LL	PI	Specific gravity
			Percentage passing sieve--						Percentage smaller than--				
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.002 mm			
											Pct		g/cc
Valentine fine sand: (S86NE-9-54)													
A------ 0 to 5	A-2-4(2)	---	---	---	---	100	99	15	10	3	NP	NP	2.61
C1----- 11 to 25	A-3(2)	---	---	---	---	100	98	8	5	3	NP	NP	2.63
C2----- 25 to 60	A-3(2)	---	---	---	---	100	98	6	3	2	NP	NP	2.62
Vetal very fine sandy loam: (S86NE-9-33)													
Ap----- 0 to 7	A-4(4)	---	---	---	---	100	95	54	28	6	NP	NP	2.60
A------ 7 to 22	A-4(3)	---	---	---	---	100	94	52	31	9	NP	NP	2.60
C2----- 36 to 60	A-3(2)	---	---	---	---	100	87	5	3	0	NP	NP	2.65

* Locations of the sampled pedons are as follows--

Calamus loamy sand: 2,300 feet south and 100 feet west of the northeast corner of sec. 6, T. 21 N., R. 24 W.

Els loamy sand: 2,500 feet north and 100 feet east of the southwest corner of sec. 15, T. 24 N., R. 22 W.

Ipage fine sand: 2,600 feet west and 1,300 feet north of the southeast corner of sec. 18, T. 23 N., R. 23 W.

Josburg loamy fine sand: 1,200 feet east and 100 feet south of the northwest corner of sec. 9, T. 21 N., R. 23 W.

Sandose loamy fine sand: 700 feet east and 250 feet north of the southwest corner of sec. 8, T. 24 N., R. 25 W.

Simeon sand: 1,900 feet south and 100 feet east of the northwest corner of sec. 23, T. 24 N., R. 25 W.

Tryon loamy fine sand: 1,000 feet south and 250 feet east of the northwest corner of sec. 8, T. 23 N., R. 23 W.

Valentine fine sand: 1,700 feet north and 300 feet west of the southeast corner of sec. 9, T. 22 N., R. 22 W.

Vetal very fine sandy loam: 2,200 feet east and 100 feet south of the northwest corner of sec. 16, T. 24 N., R. 25 W.

** The results of engineering test methods may differ from the results obtained by the soil survey procedure of the Soil Conservation Service because different procedures were used.

TABLE 19.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Almeria	Sandy, mixed, mesic Typic Fluvaquents
Bolent	Sandy, mixed, mesic Aquic Ustifluvents
Calamus	Mixed, mesic Aquic Ustipsamments
Dunn	Sandy over loamy, mixed, mesic Aquic Haplustolls
Els	Mixed, mesic Aquic Ustipsamments
Fluvaquents	Fluvaquents
Gates	Coarse-silty, mixed, nonacid, mesic Typic Ustorthents
Hersh	Coarse-loamy, mixed, nonacid, mesic Typic Ustorthents
Ipage	Mixed, mesic Aquic Ustipsamments
Jansen	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiustolls
*Josburg	Fine-loamy, mixed, mesic Typic Haplustolls
Marlake	Sandy, mixed, mesic Mollic Fluvaquents
*Meadin	Sandy, mixed, mesic Entic Haplustolls
Sandose	Sandy over loamy, mixed, mesic Typic Haplustolls
Simeon	Mixed, mesic Typic Ustipsamments
Tryon	Mixed, mesic Typic Psammaquents
Valentine	Mixed, mesic Typic Ustipsamments
Vetal	Coarse-loamy, mixed, mesic Pachic Haplustolls

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Map symbol and soil name	Land capability* N	Land capability* I	Prime farmland	Range site	Windbreak suitability group
Ab-------------------------	Vw-7	---	---	Wet Subirrigated-----	2D
Almeria					
Ac-------------------------	Vw-7	---	---	Wetland--------------	10
Almeria					
Ad-------------------------	VIw-7	---	---	---	10
Almeria					
Bg-------------------------	VIIe-5	---	---		10
Blownout land--------------				---	
Valentine------------------				Sands----------------	
Bo-------------------------	IVw-5	IVw-11	---	Subirrigated---------	2S
Bolent					
Cm-------------------------	VIe-5	IVe-14	---	Sandy----------------	7
Calamus					
DxB------------------------	IVe-6	IIIe-10	---	Sandy Lowland--------	5
Dunn					
DxF------------------------	VIe-6	---	---	Sandy----------------	7
Dunn					
DzD------------------------	VIe-6	IVe-10	---		
Dunn-----------------------				Sandy Lowland--------	7
Josburg--------------------				Sandy----------------	5
Eb-------------------------	IVw-5	IVw-11	---	Subirrigated---------	2S
Els					
EfB------------------------	VIe-5	IVe-12	---		
Els------------------------				Subirrigated---------	2S
Ipage----------------------				Sandy Lowland--------	7
Fu-------------------------	VIIIw-7	---	---	---	10
Fluvaquents					
GfC------------------------	IIIe-9	IIIe-6	Yes	Silty----------------	3
Gates					
GhG------------------------	VIIe-3	---	---		10
Gates----------------------				Silty----------------	
Hersh----------------------				Sandy----------------	
HeC------------------------	IVe-5	IVe-10	---	Sandy----------------	5
Hersh					
HfB------------------------	IIIe-3	IIe-8	Yes		
Hersh----------------------				Sandy----------------	5
Gates----------------------				Silty----------------	3
IfB------------------------	VIe-5	IVe-12	---	Sandy Lowland--------	7
Ipage					

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability* N	Land capability* I	Prime farmland	Range site	Windbreak suitability group
IgB	IVe-5	IVe-11	---	Sandy Lowland	5
Ipage					
IhB	VIe-5	IVe-12	---	Sandy	7
Ipage					
ImB	IVe-5	IVe-11	---	Sandy	5
Ipage					
ItB	VIe-5	---	---		
Ipage				Sandy Lowland	7
Tryon				Wetland	10
JnB	IVe-6	IIIe-10	---	Sandy	6G
Jansen					
JrB	IIIe-5	IIIe-10	---		5
Josburg				Sandy	
Dunn				Sandy Lowland	
Ma	VIIIw-7	---	---	---	10
Marlake					
MeF	VIs-4	---	---	Shallow to Gravel	10
Meadin					
SdB	IIIe-6	IIIe-10	---	Sandy	5
Sandose					
SmB	VIs-4	IVs-14	---	Shallow to Gravel	10
Simeon					
SmF	VIs-4	---	---	Shallow to Gravel	10
Simeon					
To	Vw-7	---	---	Wet Subirrigated	2D
Tryon					
Tp	Vw-7	---	---	Wetland	10
Tryon					
Ts	Vw-7	---	---		
Tryon				Wet Subirrigated	2D
Els				Subirrigated	2S
VaD	VIe-5	IVe-12	---	Sands	7
Valentine					
VaE	VIe-5	---	---	Sands	7
Valentine					
VaF	VIIe-5	---	---		10
Valentine, rolling				Sands	
Valentine, hilly				Choppy Sands	
VeB	IVe-5	IVe-11	---	Sandy	5
Valentine					
VeD	VIe-5	IVe-11	---	Sands	7
Valentine					

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability* N	Land capability* I	Prime farmland	Range site	Windbreak suitability group
VmD	VIe-5	IVe-12	---		
Valentine				Sands	7
Els				Subirrigated	2S
VoD	VIe-6	IVe-10	---		
Valentine				Sands	7
Sandose				Sandy	5
VsD	VIe-5	IVe-12	---		
Valentine				Sands	7
Simeon				Shallow to Gravel	10
VuC Vetal	IVe-5	IVe-10	---	Sandy	5
Vv Vetal	IIc-1	I-6	Yes	Silty	5

* A soil complex is treated as a single unit in land capability and prime farmland columns. The N column is for nonirrigated soils; the I column is for irrigated soils.

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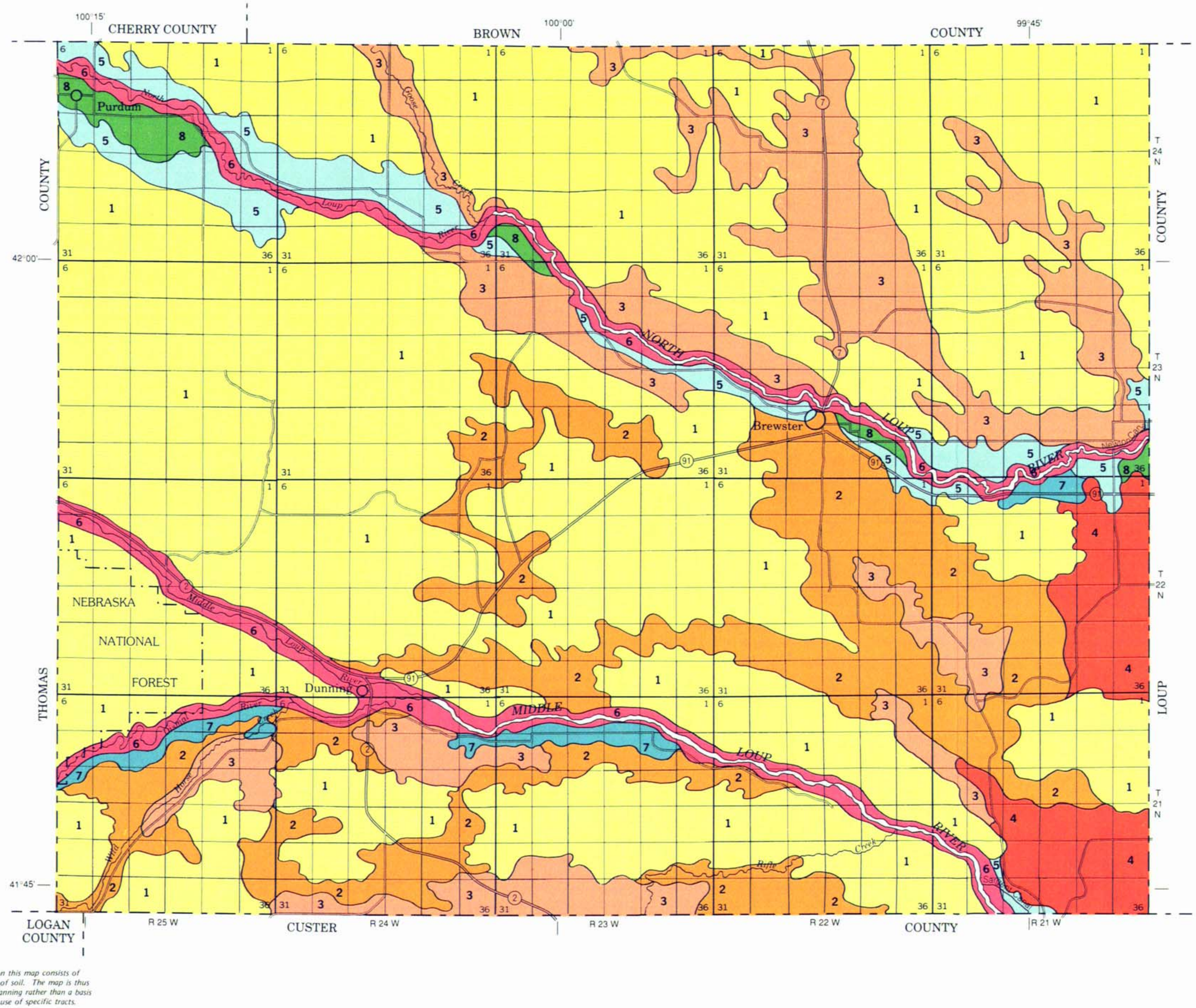


SOIL LEGEND*

1	VALENTINE ASSOCIATION
2	VALENTINE-IPAGE ASSOCIATION
3	VALENTINE-ELS-IPAGE ASSOCIATION
4	VALENTINE-HERSH-GATES ASSOCIATION
5	IPAGE-VALENTINE-SIMEON ASSOCIATION
6	ALMERIA-IPAGE-FLUVAQUENTS ASSOCIATION
7	DUNN-JOSBURG-VALENTINE ASSOCIATION
8	VETAL-SANDOSE ASSOCIATION

* The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1990

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

N

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF NEBRASKA
CONSERVATION AND SURVEY DIVISION

GENERAL SOIL MAP

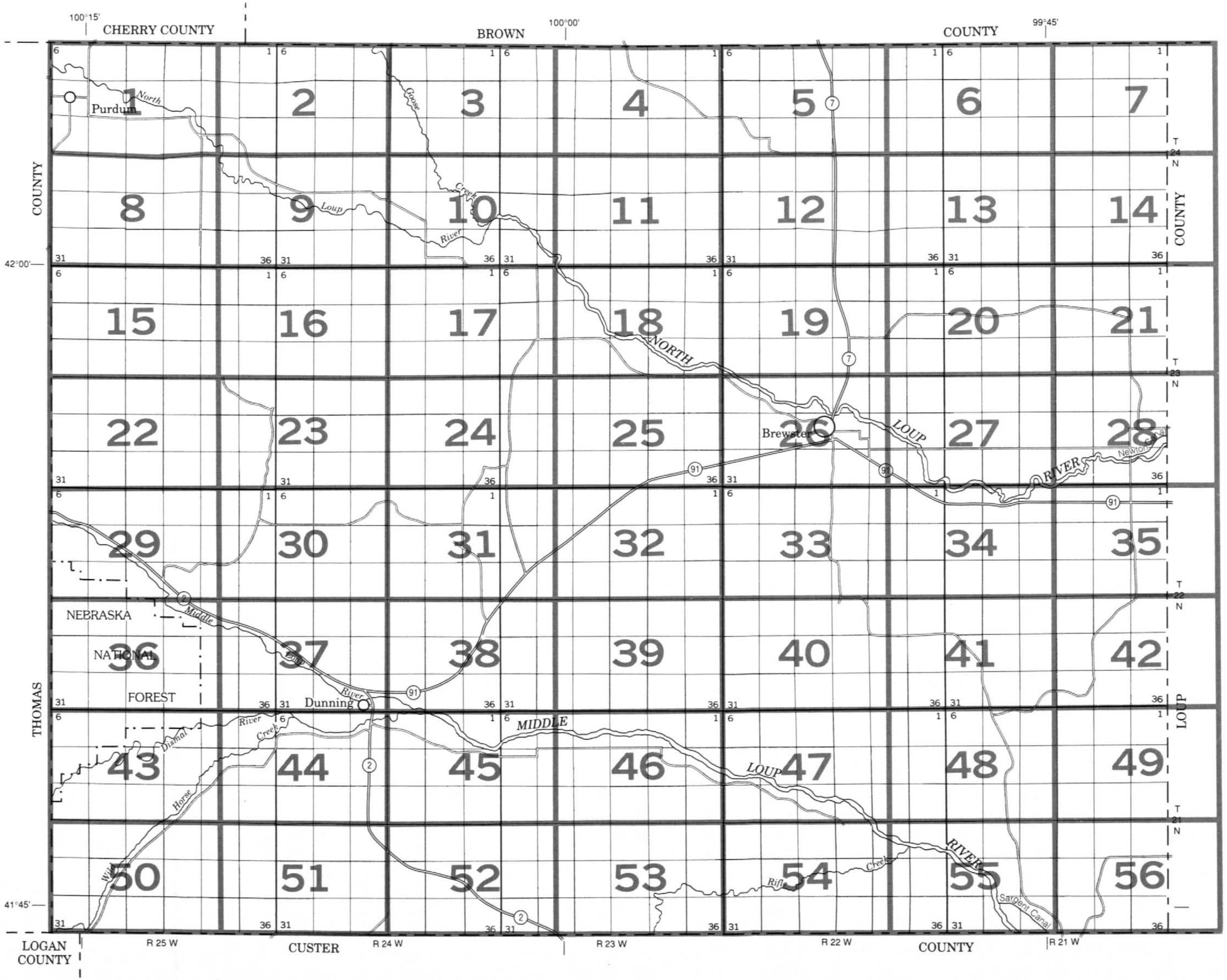
BLAINE COUNTY, NEBRASKA

Scale 1:253,440

1 0 1 2 3 4 Mi

1 0 4 8 Km

Original text from each individual map sheet read:
This map was compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

N

INDEX TO MAP SHEETS

BLAINE COUNTY, NEBRASKA

Scale 1:253,440

1 0 1 2 3 4 Mi

1 0 4 8 Km

SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is moderately eroded and 3 that it is severely eroded.

SYMBOL	NAME
Ab	Almeria loamy fine sand, 0 to 2 percent slopes
Ac	Almeria loamy fine sand, wet, 0 to 2 percent slopes
Ad	Almeria loamy fine sand, channeled
Bg	Blownout land-Valentine complex, 6 to 60 percent slopes
Bo	Bolent loamy sand, 0 to 2 percent slopes
Cm	Calamus loamy sand, 0 to 2 percent slopes
DxB	Dunn loamy fine sand, 0 to 3 percent slopes
DxF	Dunn loamy fine sand, 9 to 20 percent slopes
DzD	Dunn-Josburg loamy fine sands, 3 to 9 percent slopes
Eb	Els loamy sand, 0 to 2 percent slopes
EfB	Els-Ipage complex, 0 to 3 percent slopes
Fu	Fluvaquents, sandy
GfC	Gates very fine sandy loam, 3 to 6 percent slopes
GhG	Gates-Hersh complex, 20 to 60 percent slopes
HeC	Hersh loamy fine sand, 3 to 6 percent slopes
HfB	Hersh-Gates complex, 0 to 3 percent slopes
IfB	Ipage fine sand, 0 to 3 percent slopes
IgB	Ipage loamy fine sand, 0 to 3 percent slopes
IhB	Ipage sand, terrace, 0 to 3 percent slopes
ImB	Ipage loamy fine sand, terrace, 0 to 3 percent slopes
ItB	Ipage-Tryon complex, 0 to 3 percent slopes
JnB	Jansen loamy fine sand, 0 to 3 percent slopes
JrB	Josburg-Dunn loamy fine sands, 0 to 3 percent slopes
Ma	Marlake loamy fine sand, 0 to 2 percent slopes
MeF	Meadin loamy sand, 3 to 30 percent slopes
SdB	Sandose loamy fine sand, 0 to 3 percent slopes
SmB	Simeon sand, 0 to 3 percent slopes
SmF	Simeon sand, 3 to 30 percent slopes
To	Tryon loamy fine sand, 0 to 2 percent slopes
Tp	Tryon loamy fine sand, wet, 0 to 2 percent slopes
Ts	Tryon-Els loamy fine sand, 0 to 2 percent slopes
VaD	Valentine fine sand, 3 to 9 percent slopes
VaE	Valentine fine sand, rolling
VaF	Valentine fine sand, rolling and hilly
VeB	Valentine loamy fine sand, 0 to 3 percent slopes
VeD	Valentine loamy fine sand, 3 to 9 percent slopes
VmD	Valentine-Els complex, 0 to 9 percent slopes
VoD	Valentine-Sandose loamy fine sands, 0 to 9 percent slopes
VsD	Valentine-Simeon complex, 0 to 9 percent slopes
VuC	Vetal loamy fine sand, 3 to 6 percent slopes
Vv	Vetal very fine sandy loam, 0 to 2 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- County
- Reservation (national forest or park, state forest or park, and large airport)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, or cemetery — Davis Airstrip

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- State — 52

RAILROAD

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit (up to 5 acres)

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Located object (label)

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
- Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp (up to 3 acres)
- Spring
- Well, irrigation
- Wet spot (up to 3 acres)

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — VaF VmD

ESCARPMENTS

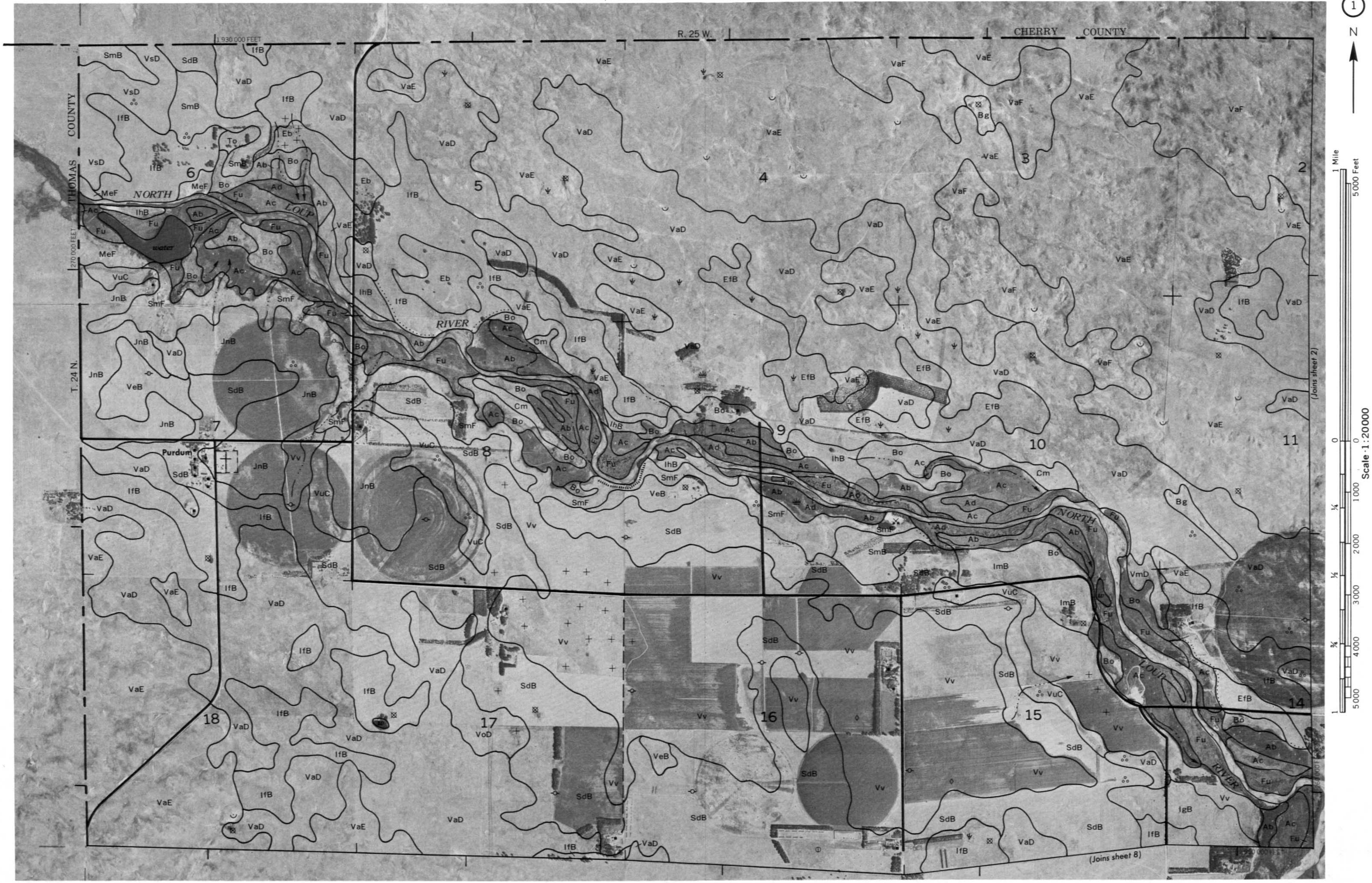
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

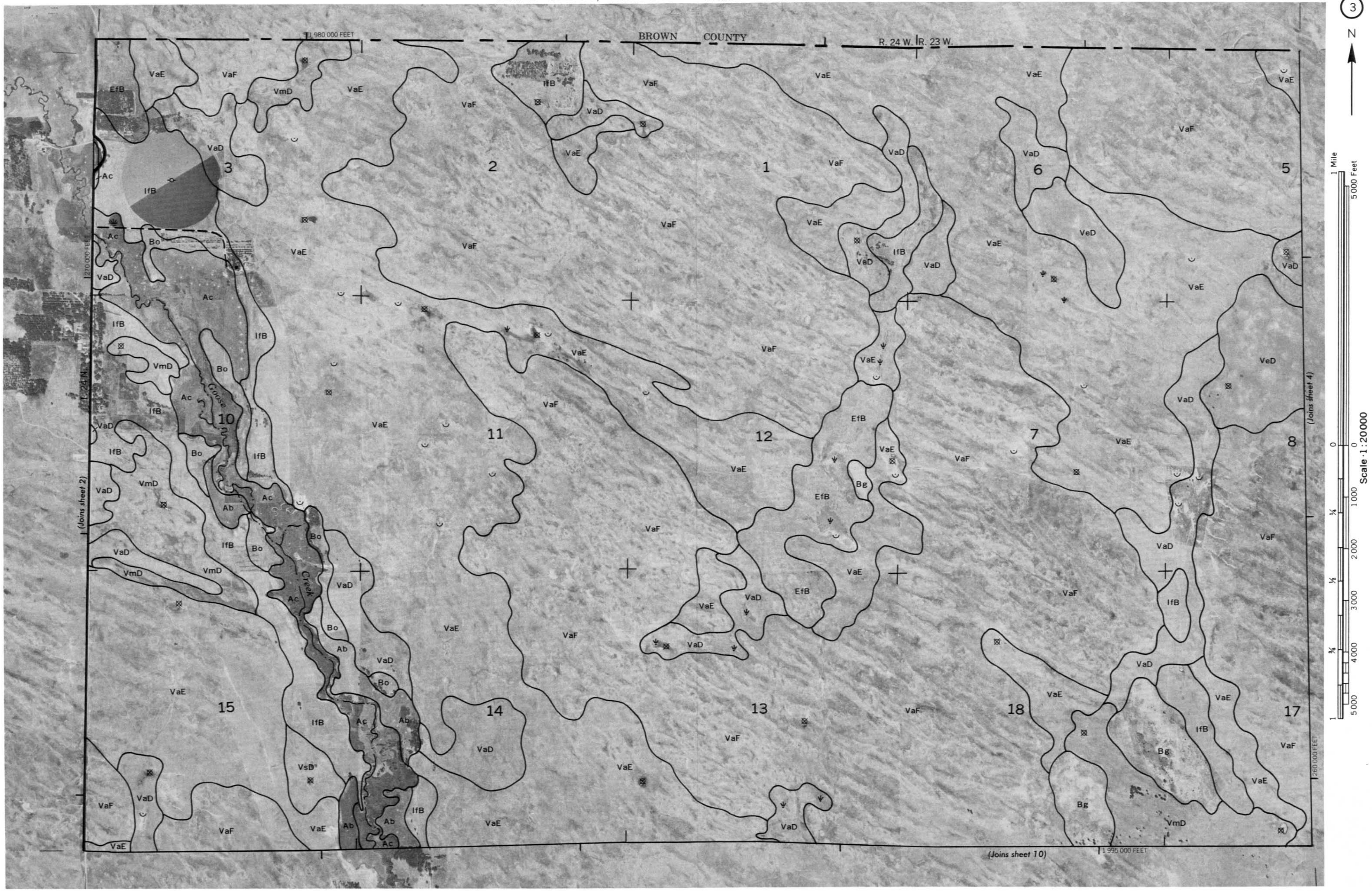
DEPRESSION OR SINK (up to 5 acres)

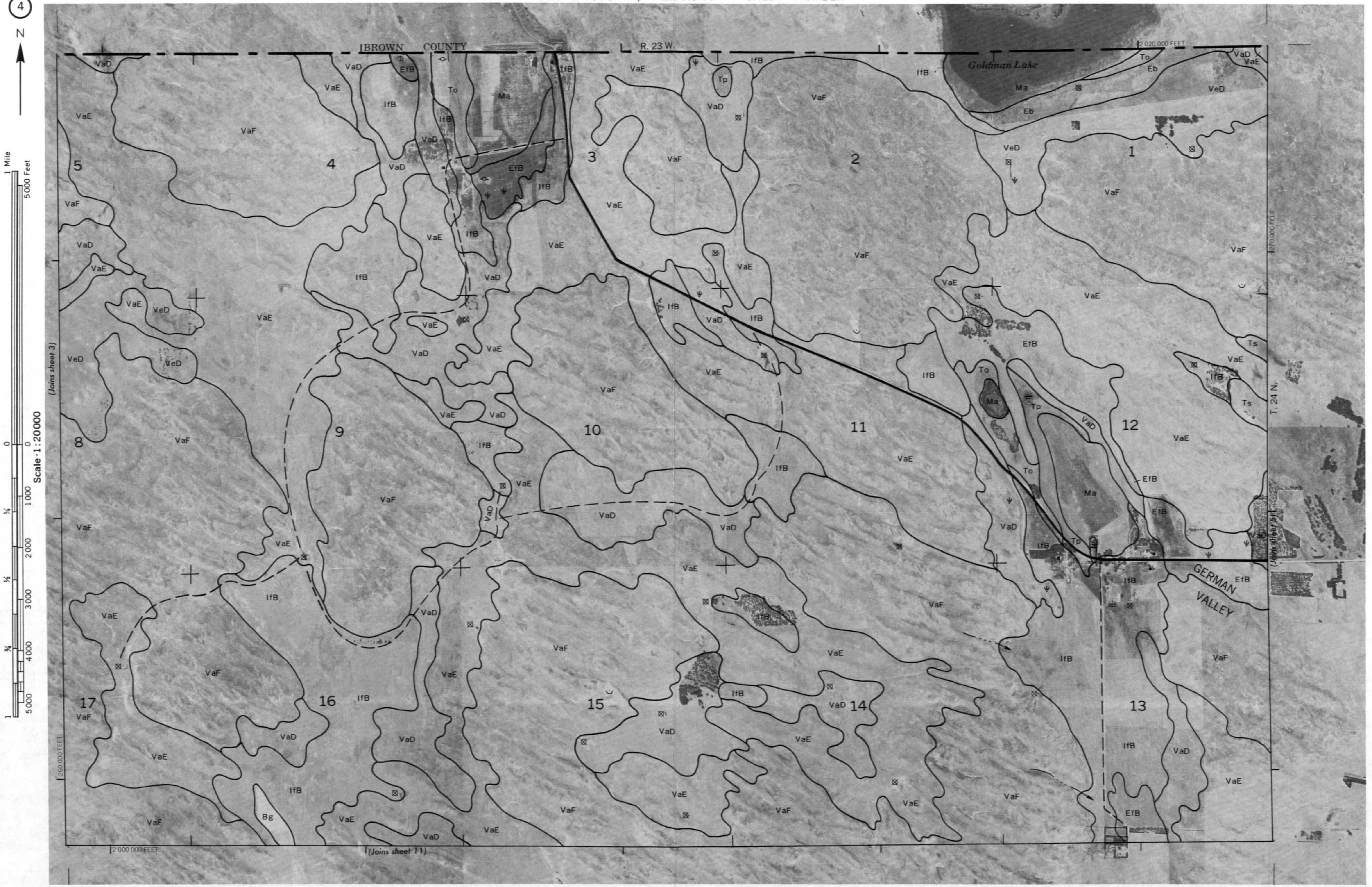
MISCELLANEOUS

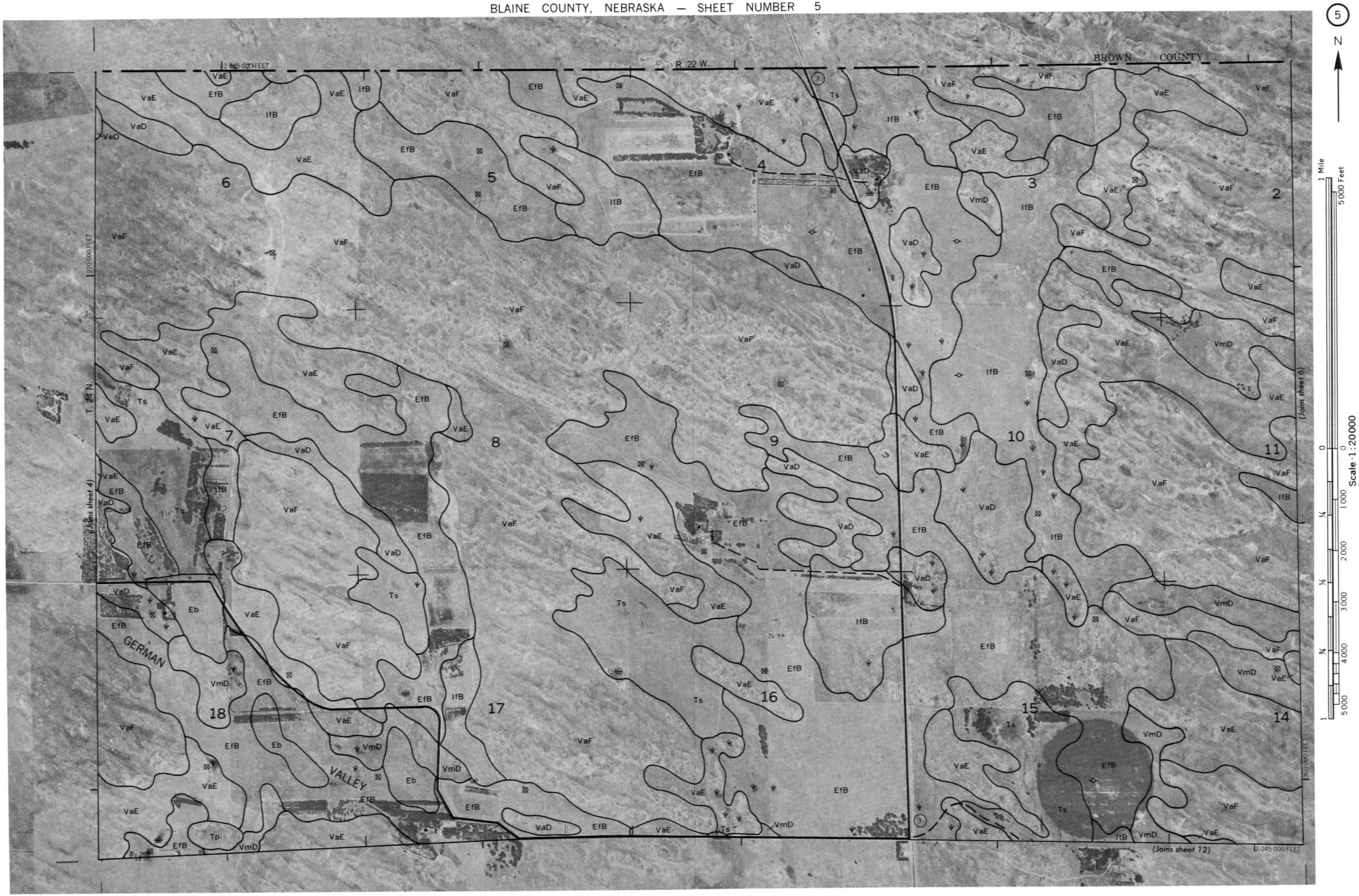
- Blowout (up to 5 acres)
- Gravelly spot (up to 3 acres)
- Saline spot (up to 5 acres)
- Sandy spot (up to 5 acres)
- Severely eroded spot (up to 5 acres)
- Borrow pit (up to 5 acres)
- Livestock watering facility
- Loamy material in sand (up to 3 acres)
- Clayey depressional area (up to 5 acres)
- Seep area (up to 3 acres) — #


1
N
CHERRY COUNTY
THOMAS COUNTY
R. 25 W.
T. 24 N.
1 930 000 FEET
270 000 FEET
NORTH LOUP RIVER
NORTH LOUP RIVER
Purdum
water
(Joins sheet 2)
(Joins sheet 8)
1 Mile
5000 Feet
Scale 1:20000
1
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18

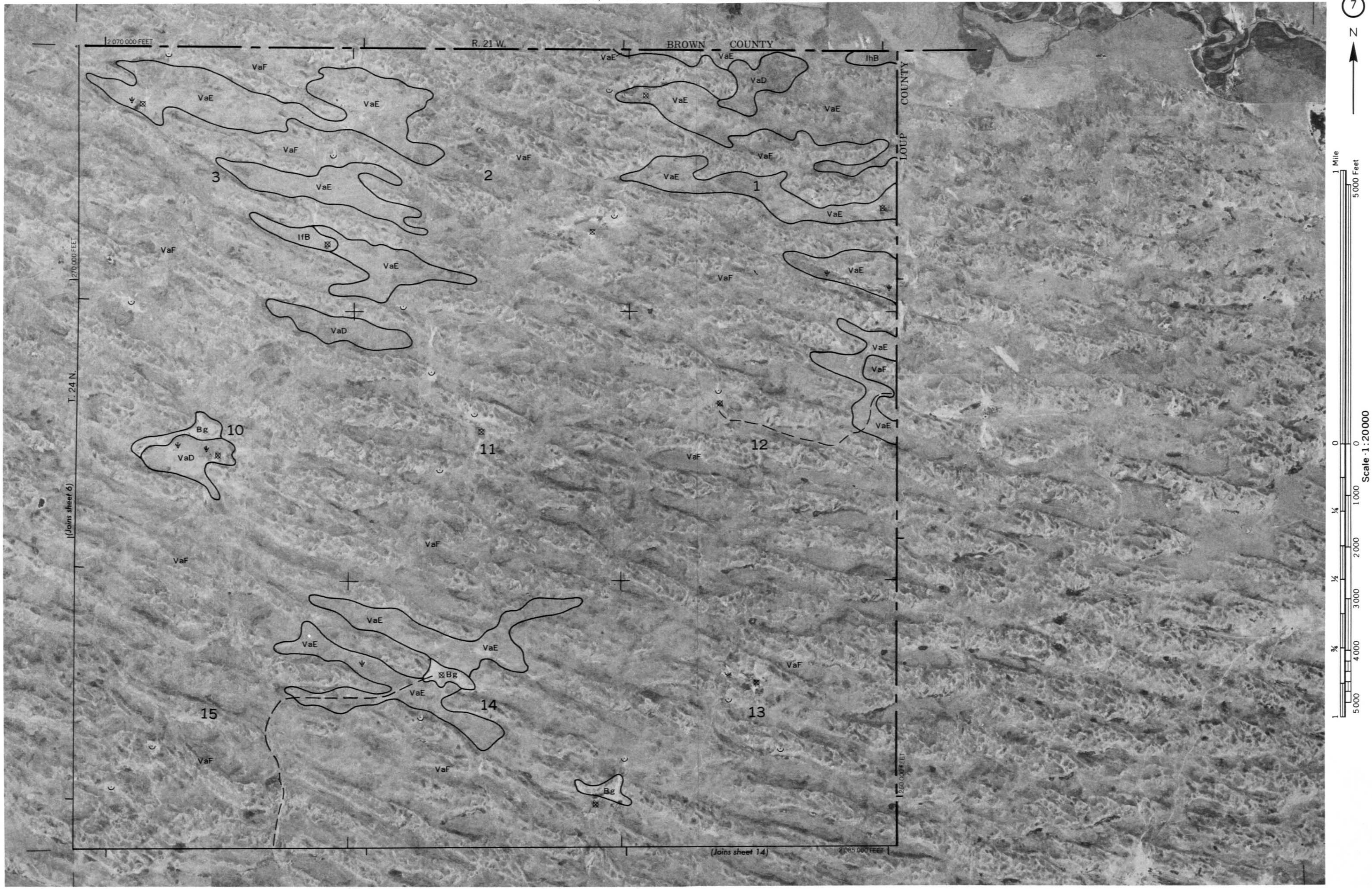

2
N
CHERRY COUNTY
BROWN COUNTY
R. 25 W.
R. 24 W.
1 975 000 FEET
T. 24 N.
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 9)
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
VaF
VaE
VaD
VmD
Bg
IfB
Eb
EfB
Ac
Ab
Fu
SmB
IhB
ImB
Goose
LOUP
RIVER

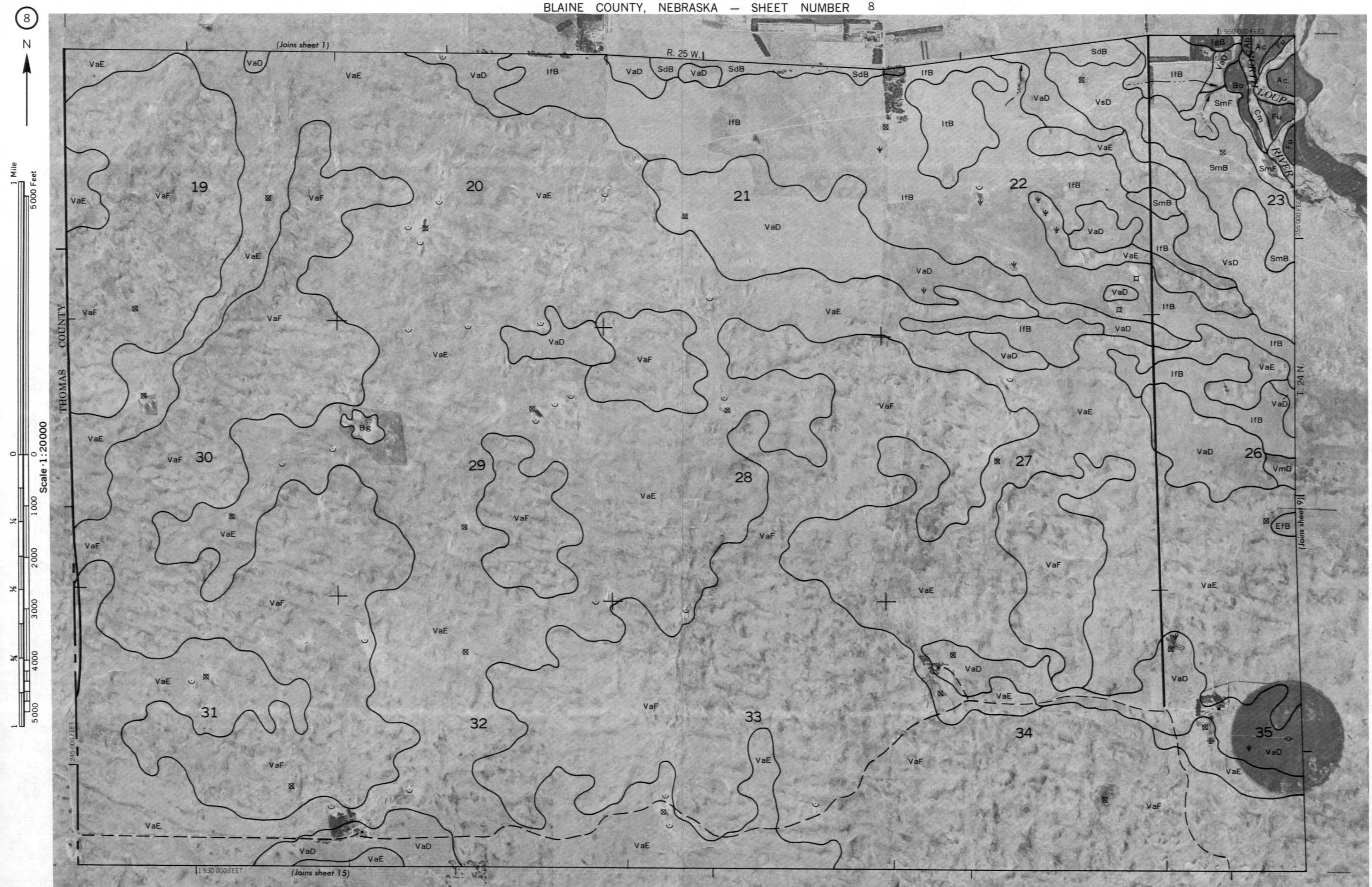

BROWN COUNTY
1 980 000 FEET
R. 24 W. R. 23 W.
270 000 FEET
T. 24 N.
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 10)
1 995 000 FEET
260 000 FEET
Goose
Creek
3
N
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000

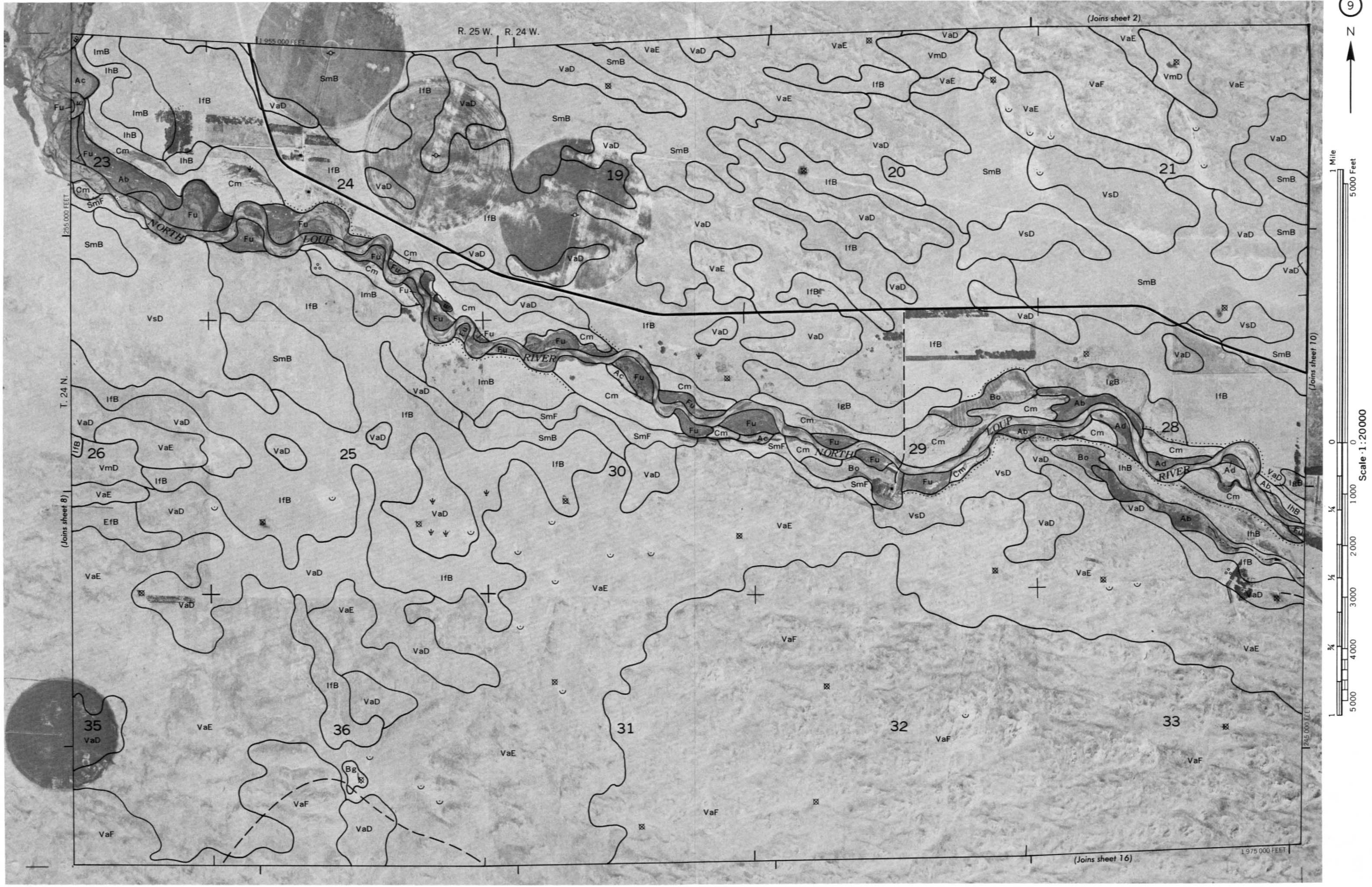

4
N
1 Mile
5000 Feet
0
0
Scale 1:20000
1000
¼
2000
½
3000
¾
4000
5000
1
BROWN COUNTY
R. 23 W.
2 020 000 FEET
Goldman Lake
T. 24 N.
270 000 FEET
260 000 FEET
2 000 000 FEET
(Joins sheet 3)
(Joins sheet 11)
(Joins sheet 5)
GERMAN VALLEY
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
VaD
VaE
VaF
VeD
IfB
EfB
Eb
Ma
To
Tp
Ts
Bg

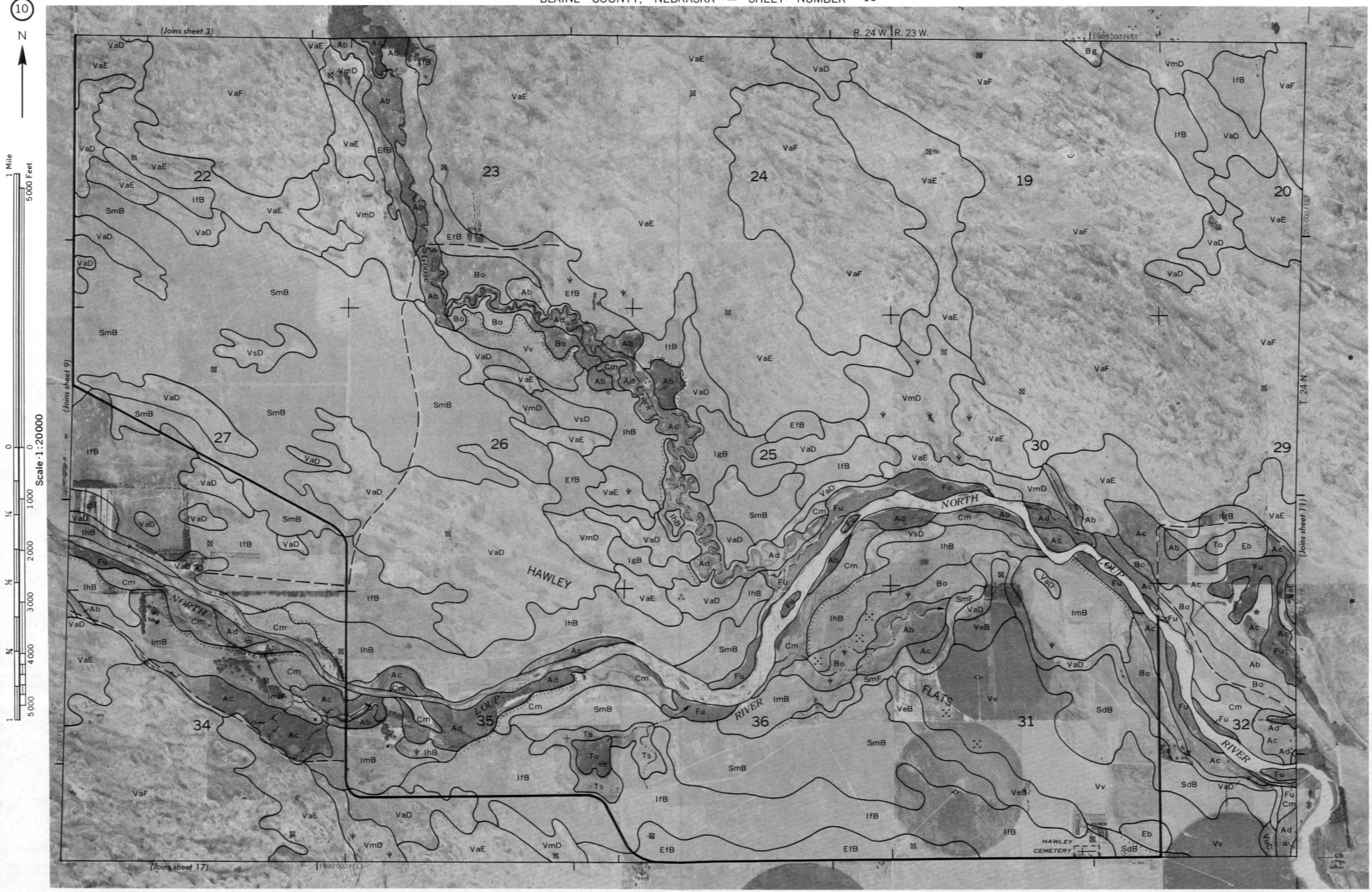

5
N
BROWN COUNTY
R. 22 W.
T. 24 N.
2 085 000 FEET
270 000 FEET
250 000 FEET
2 045 000 FEET
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 12)
GERMAN
VALLEY
1 Mile
5000 Feet
Scale 1:20000
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18
VaE
VaF
VaD
EfB
IfB
VmD
Ts
Eb
Tp
ItB

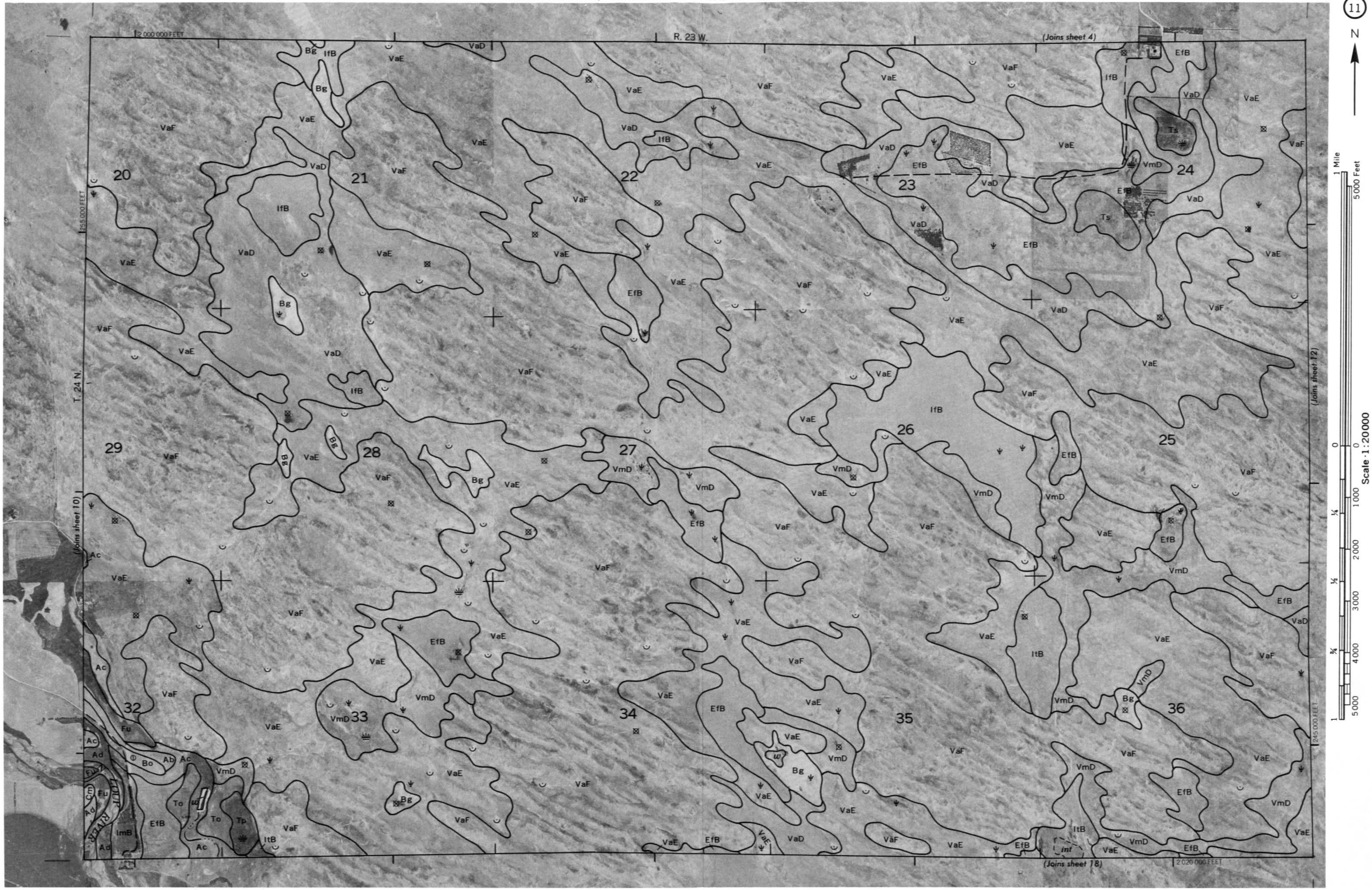

6
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
BROWN COUNTY
R. 22 W.
R. 21 W.
2 065 000 FEET
270 000 FEET
250 000 FEET
2 050 000 FEET
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 13)
T. 24 N.
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
VaE
VaF
VaD
VmD
IfB
Bg

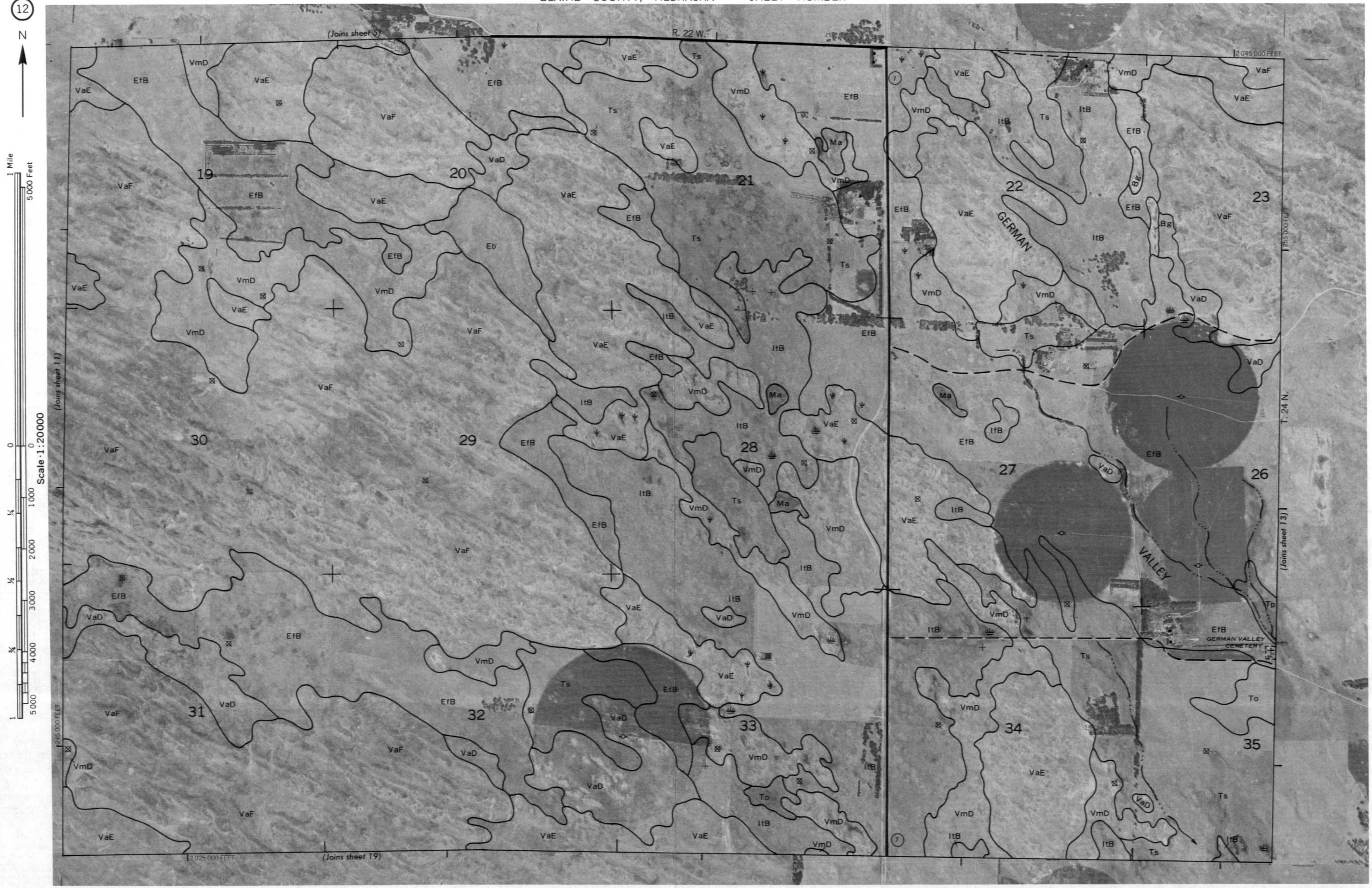

7
N
2 070 000 FEET
R. 21 W.
BROWN COUNTY
LOUP COUNTY
T. 24 N.
270 000 FEET
(Joins sheet 6)
(Joins sheet 14)
2 085 000 FEET
250 000 FEET
VaF
VaE
VaD
IhB
IfB
Bg
1
2
3
10
11
12
13
14
15
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000


8
N
Scale 1:20000
1 Mile
5000 Feet
(Joins sheet 1)
R. 25 W.
THOMAS COUNTY
T. 24 N.
(Joins sheet 9)
(Joins sheet 15)
1 950 000 FEET
1 930 000 FEET
245 000 FEET
LOUP
RIVER
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
VaE
VaD
VaF
IfB
SdB
VsD
SmB
SmF
Bo
Ac
Fu
Cm
Bg
VmD
EfB


9
N
(Joins sheet 2)
R. 25 W.
R. 24 W.
1 955 000 FEET
255 000 FEET
T. 24 N.
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 16)
245 000 FEET
1 975 000 FEET
NORTH LOUP RIVER
NORTH LOUP RIVER
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000

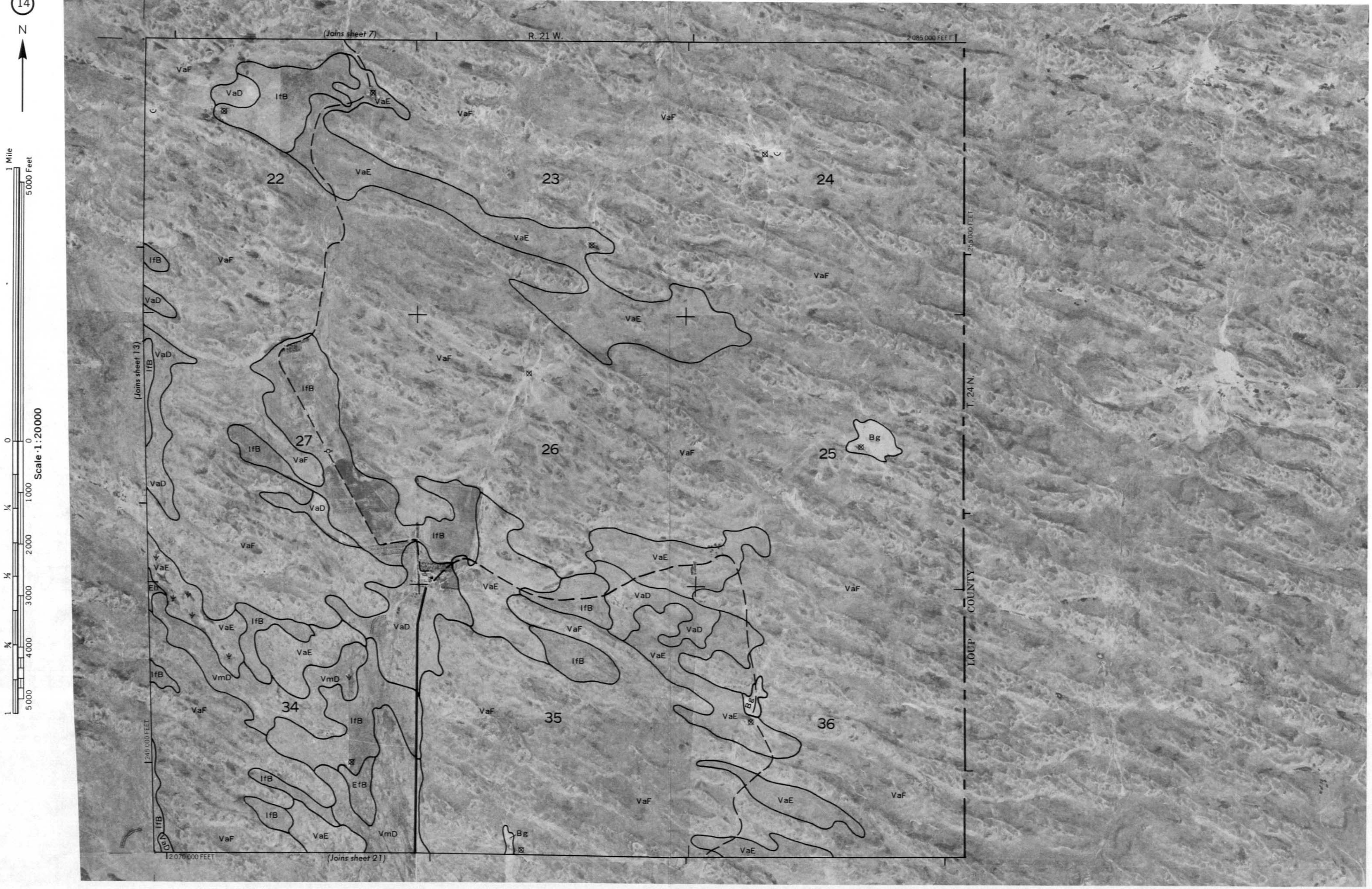

10
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 3)
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 17)
R. 24 W.
R. 23 W.
T. 24 N.
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32
Goose Creek
HAWLEY
NORTH LOUP RIVER
HAWLEY FLATS
HAWLEY CEMETERY
1 880 000 FEET


11
N
(Joins sheet 4)
(Joins sheet 10)
(Joins sheet 12)
(Joins sheet 18)
R. 23 W.
T. 24 N.
2 000 000 FEET
2 020 000 FEET
255 000 FEET
245 000 FEET
LOUP RIVER
1 Mile
5000 Feet
Scale 1:20000
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36


12
N
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000
(Joins sheet 5)
R. 22 W.
2 045 000 FEET
255 000 FEET
T. 24 N.
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 19)
2 025 000 FEET
245 000 FEET
GERMAN
VALLEY
GERMAN VALLEY CEMETERY
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
EfB
VaE
VaF
VaD
VmD
Ts
Ma
ItB
Eb
Bg
To
Tp

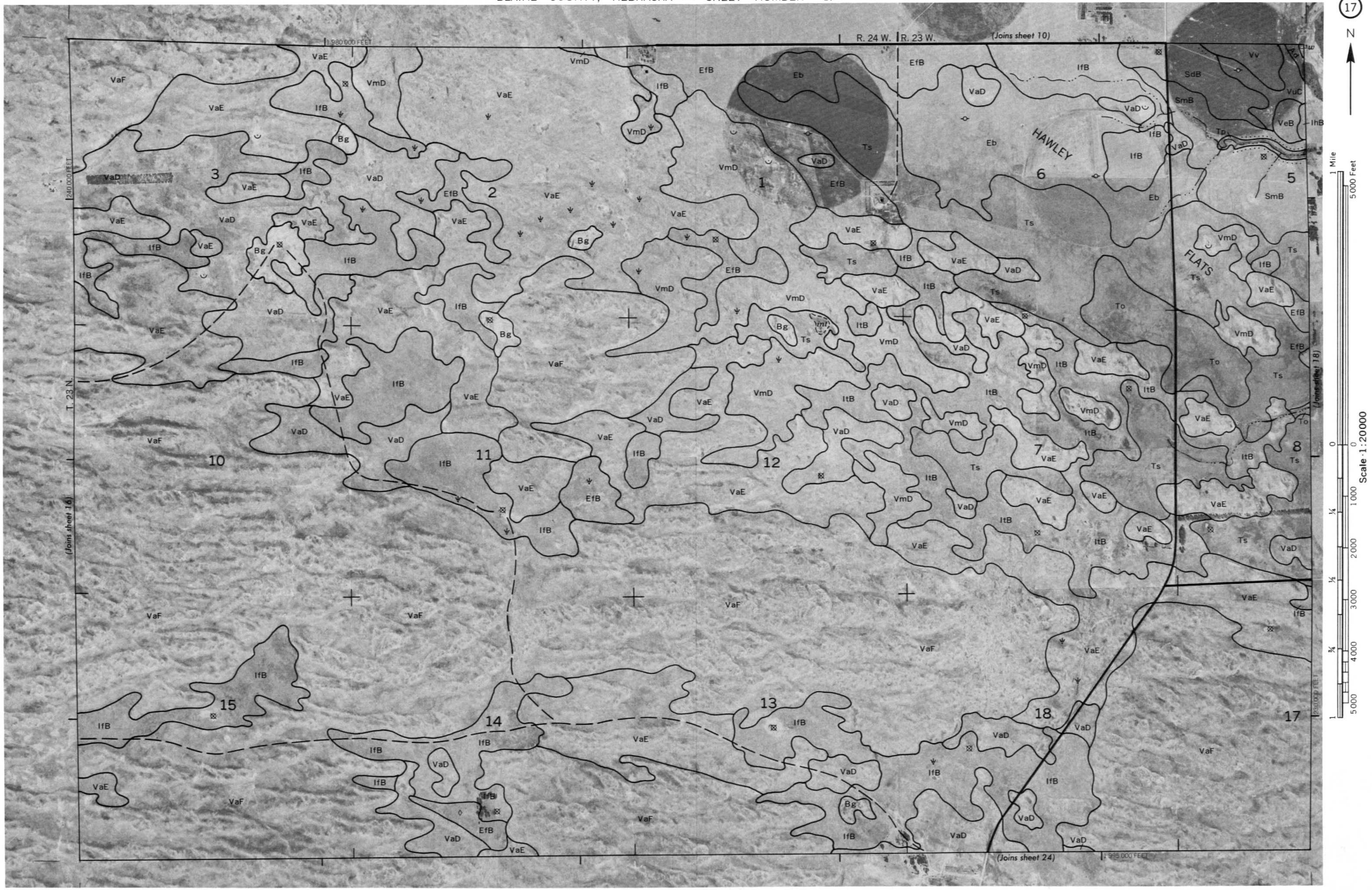

13
N
R. 22 W. | R. 21 W.
2 050 000 FEET
(Joins sheet 6)
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 20)
2 065 000 FEET
255 000 FEET
245 000 FEET
T. 24 N.
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
1 Mile
5000 Feet
Scale 1:20 000

BLAINE COUNTY, NEBRASKA — SHEET NUMBER 14

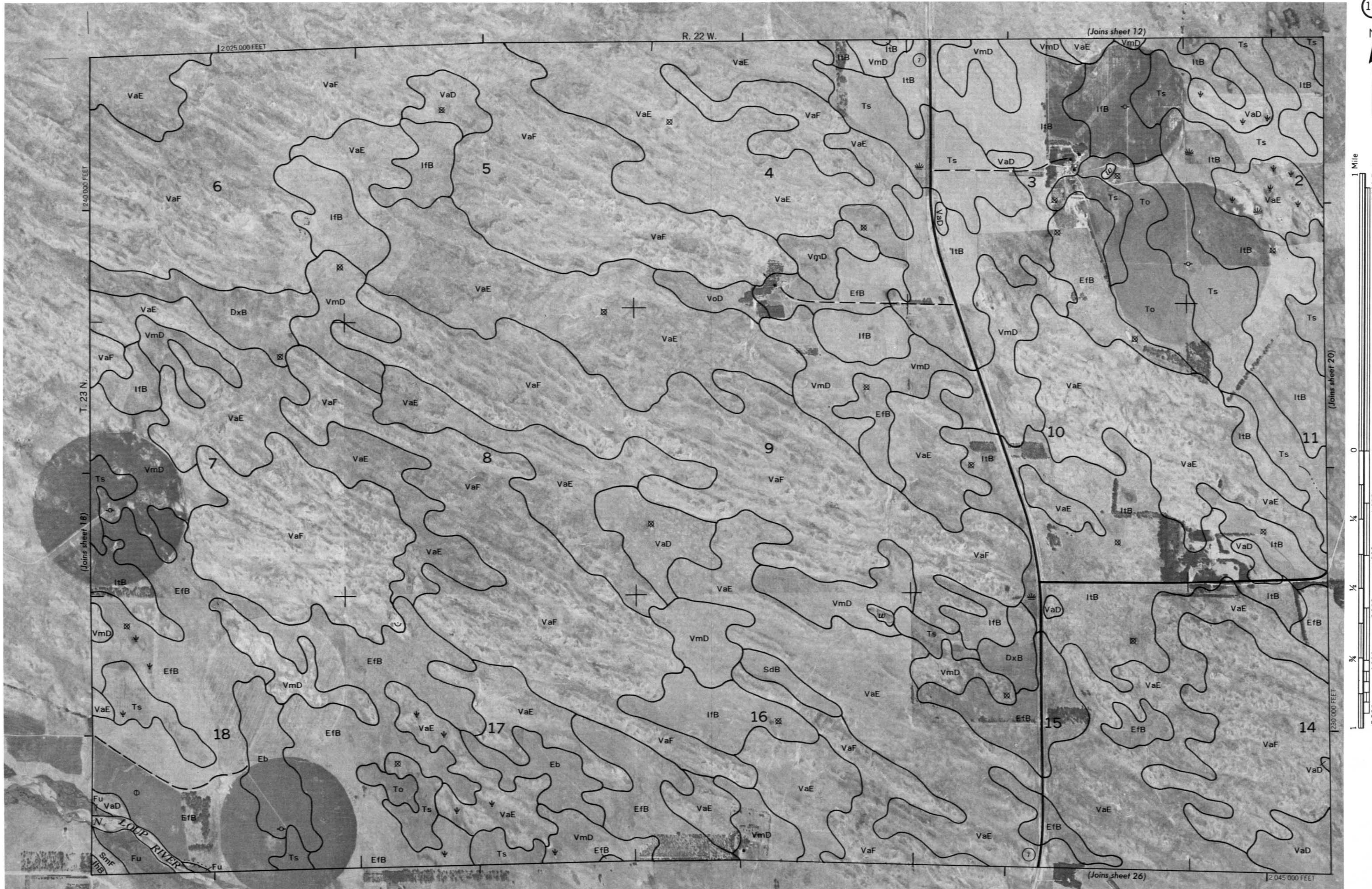


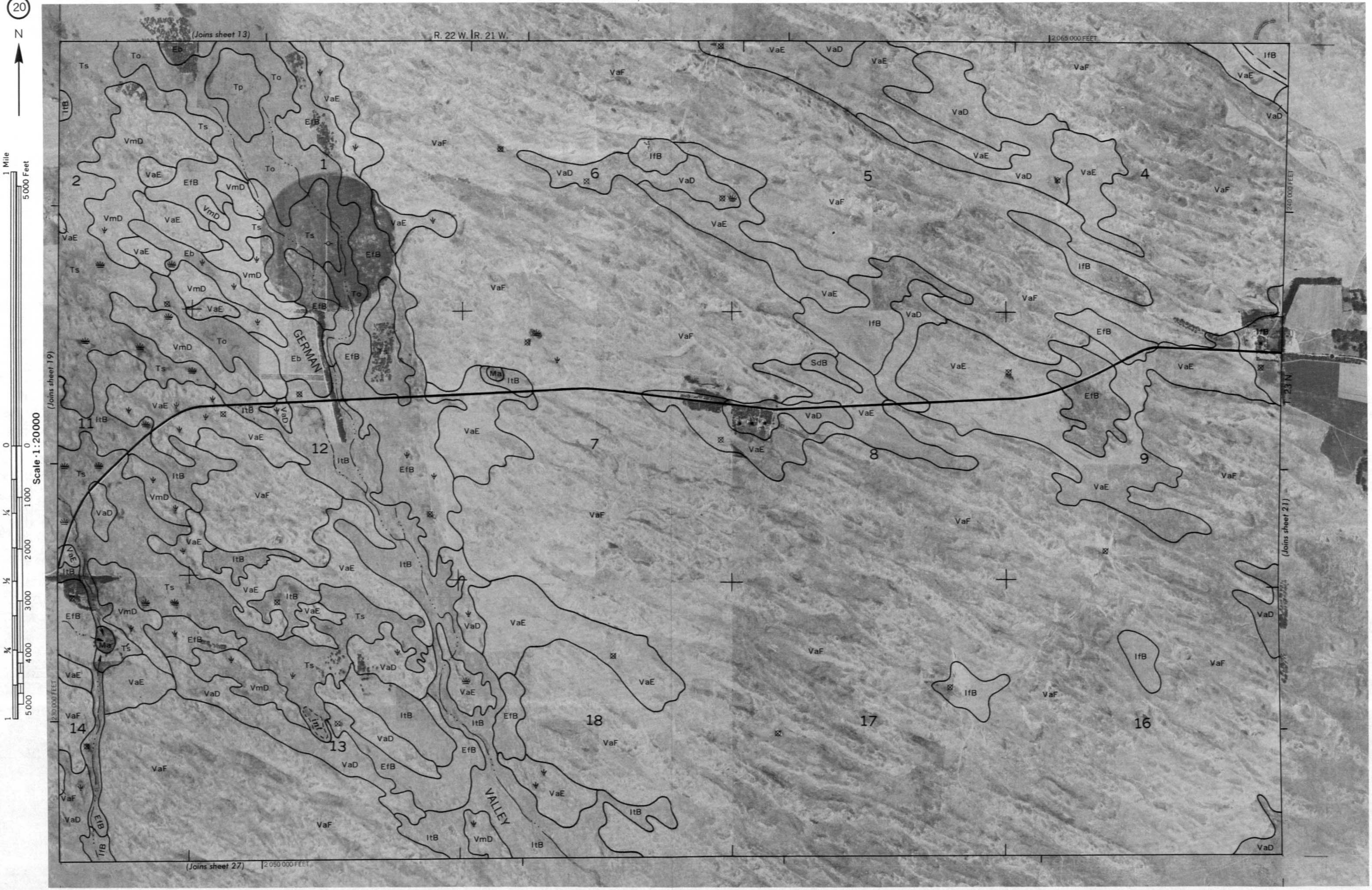

15
N
1 930 000 FEET
R. 25 W.
(Joins sheet 8)
240 000 FEET
T. 23 N.
THOMAS COUNTY
(Joins sheet 16)
(Joins sheet 22)
1 950 000 FEET
VaE
VaF
VaD
Bg
1
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18
1 Mile
5000 Feet
Scale 1:20000

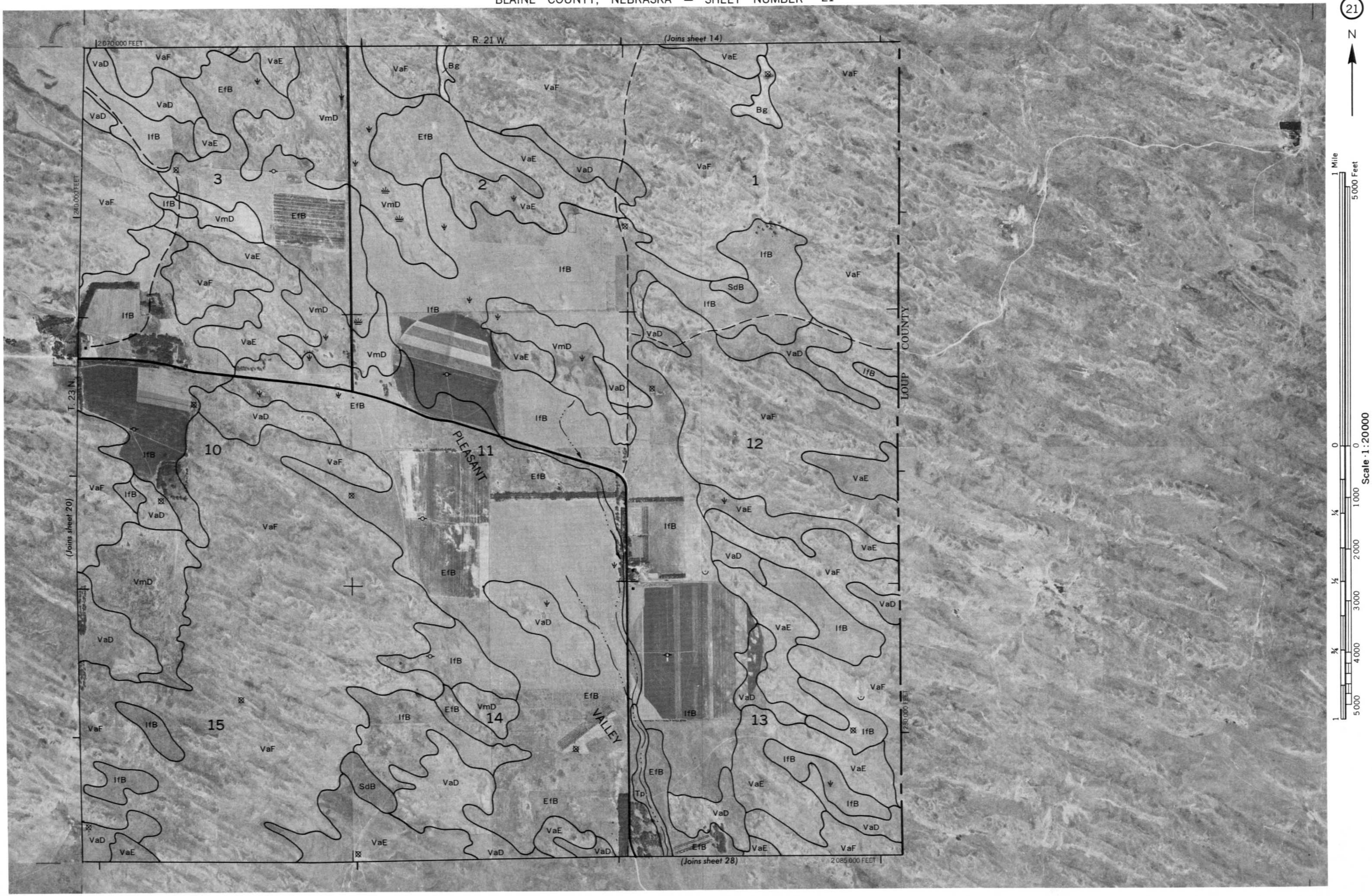

16
N
1 Mile
5 000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
Scale 1:20000
R. 25 W.
R. 24 W.
T. 23 N.
(Joins sheet 9)
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 23)
1 975 000 FEET
340 000 FEET
330 000 FEET
1 955 000 FEET
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
VaF
VaE
VaD
Bg
IfB

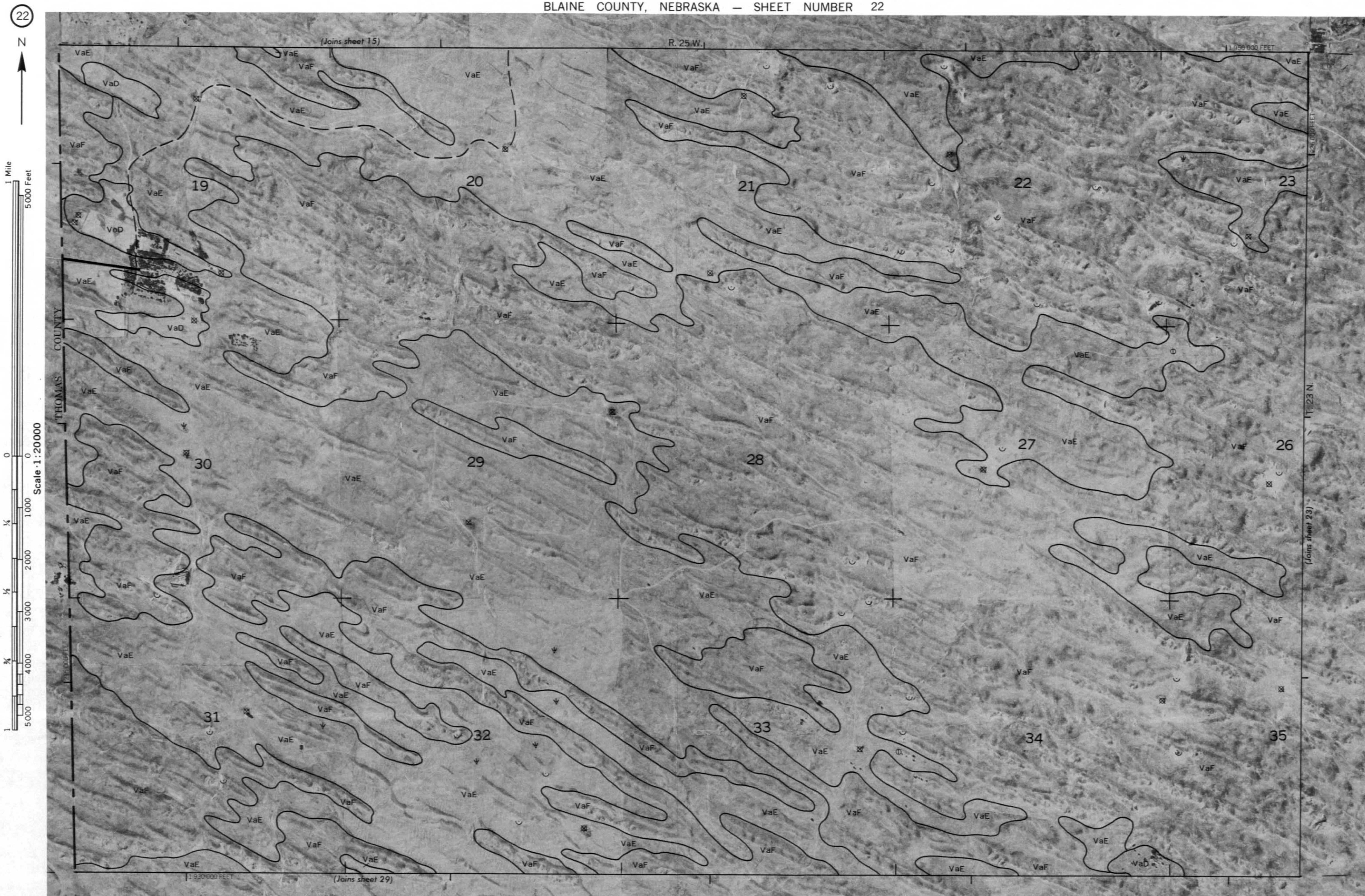

17
N
R. 24 W.
R. 23 W.
(Joins sheet 10)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 24)
T. 23 N.
HAWLEY
FLATS
1 980 000 FEET
240 000 FEET
1 995 000 FEET
1 Mile
5000 Feet
Scale 1:20000

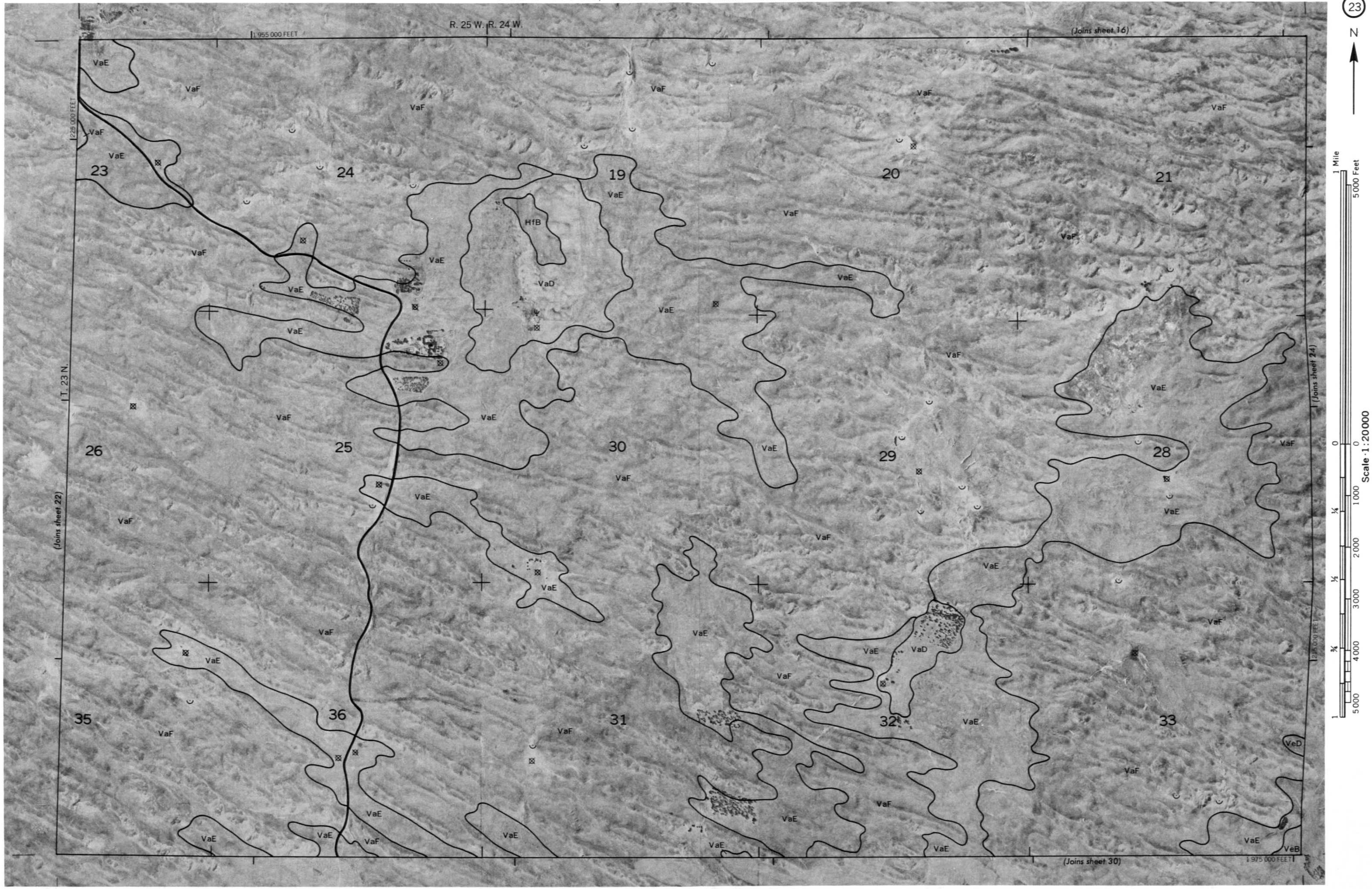

18
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 11)
R. 23 W.
2 020 000 FEET
240 000 FEET
T. 23 N.
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 25)
2 000 000 FEET
230 000 FEET
NORTH LOUP RIVER
HAWLEY FLATS
Landing Strip


19
N
(Joins sheet 12)
(Joins sheet 26)
(Joins sheet 18)
(Joins sheet 20)
R. 22 W.
T. 23 N.
2 025 000 FEET
240 000 FEET
230 000 FEET
2 045 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
N. LOUP RIVER
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18

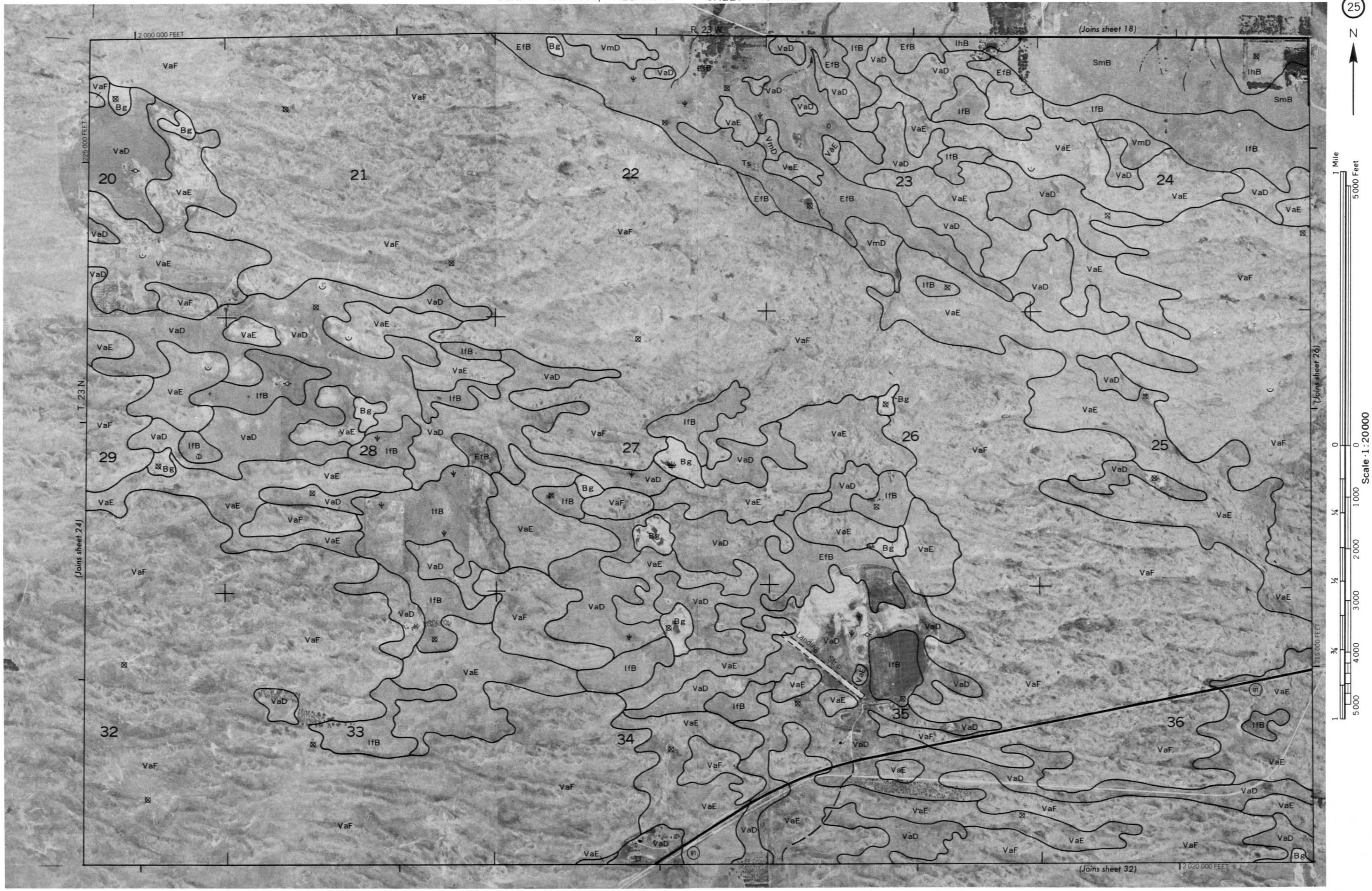

20
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 13)
R. 22 W.
R. 21 W.
2 065 000 FEET
240 000 FEET
T. 23 N.
(Joins sheet 21)
(Joins sheet 19)
(Joins sheet 27)
2 050 000 FEET
210 000 FEET
GERMAN
VALLEY
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
VaF
VaE
VaD
IfB
ItB
EfB
Eb
Ts
To
Tp
VmD
SdB
Ma
Tm


21
N
(Joins sheet 14)
R. 21 W.
2 070 000 FEET
240 000 FEET
T. 23 N.
(Joins sheet 20)
(Joins sheet 28)
2 085 000 FEET
230 000 FEET
LOUP COUNTY
PLEASANT
VALLEY
1
2
3
10
11
12
13
14
15
VaD
VaE
VaF
VmD
EfB
IfB
Bg
SdB
Tp
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000

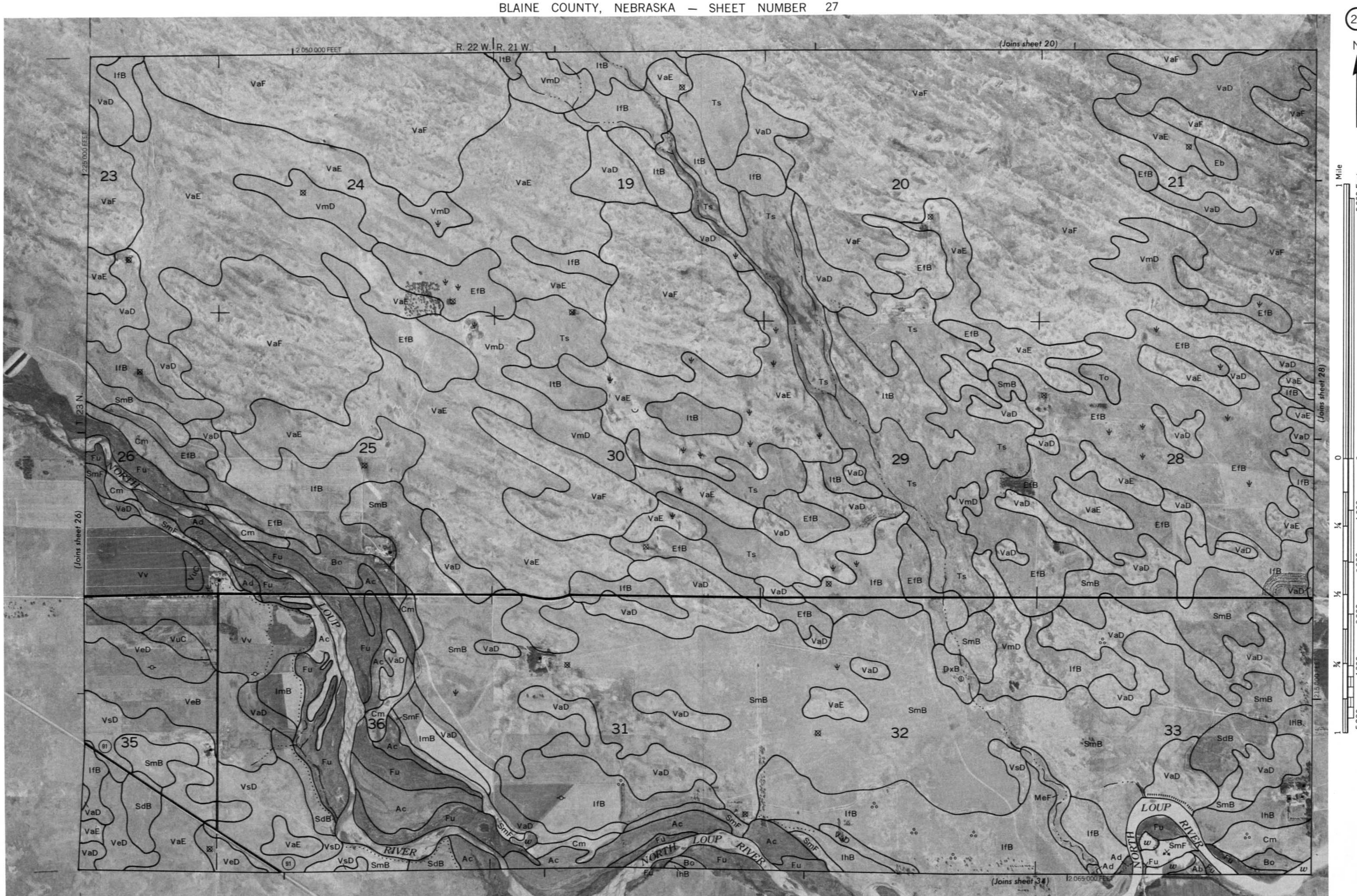

22
N
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000
(Joins sheet 15)
R. 25 W.
THOMAS COUNTY
T. 23 N.
(Joins sheet 23)
(Joins sheet 29)
1 930 000 FEET
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
VaD
VaE
VaF

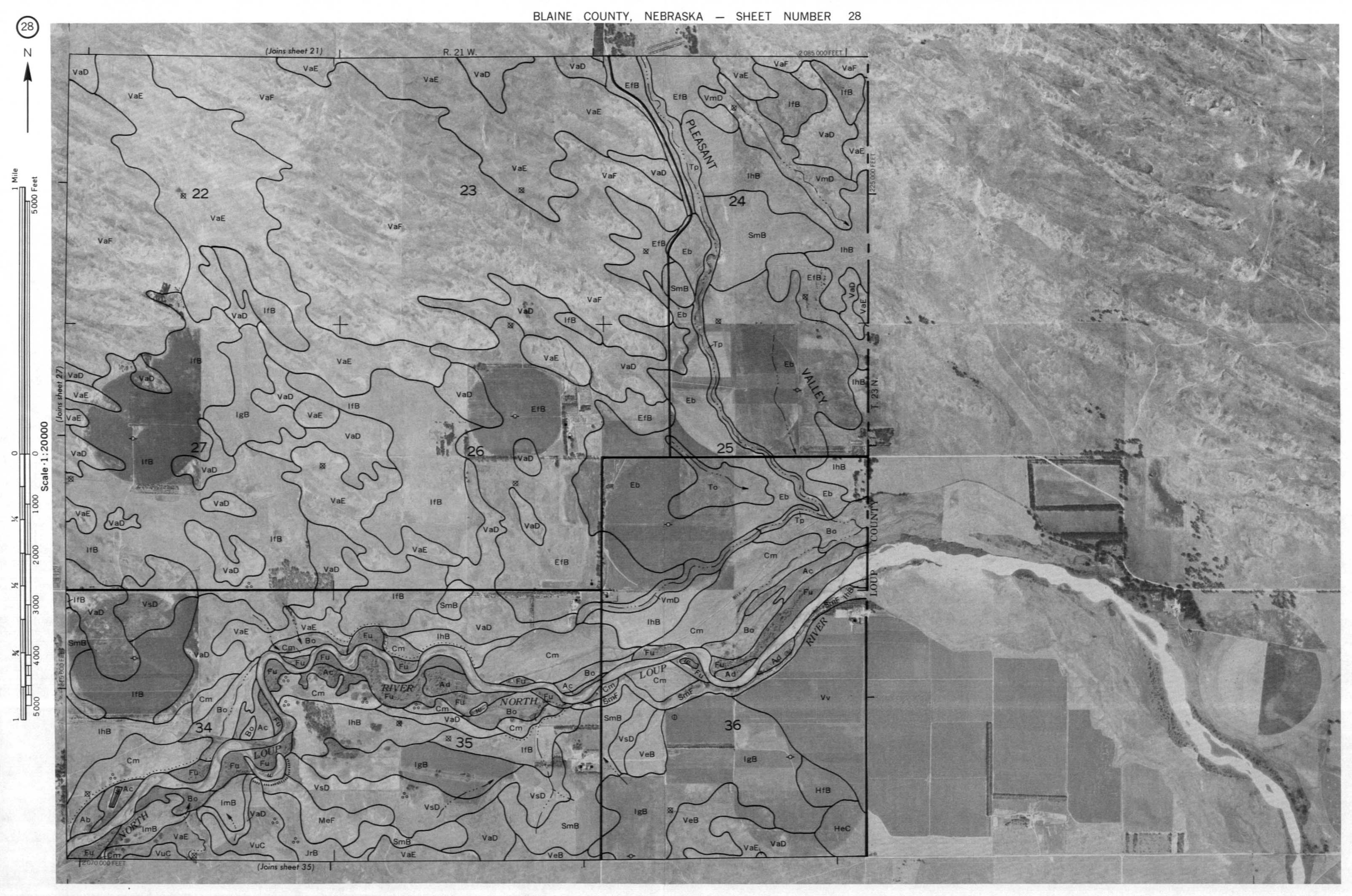

23
N
R. 25 W. R. 24 W.
1 955 000 FEET
(Joins sheet 16)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 30)
T. 23 N.
228 000 FEET
1 975 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
VaE
VaF
VaD
HfB
VeD
VeB


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
(Joins sheet 17)
R. 24 W. | R. 23 W.
1 995 000 FEET
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 31)
1 980 000 FEET
T. 23 N.
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
VaF
VaE
VaD
VaB
IfB
HfB
VeD
VoD
SdB


25
N
(Joins sheet 18)
R. 23 W.
2 000 000 FEET
225 000 FEET
T. 23 N.
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 32)
215 000 FEET
2 020 000 FEET
Landing Strip
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
Scale 1:20000

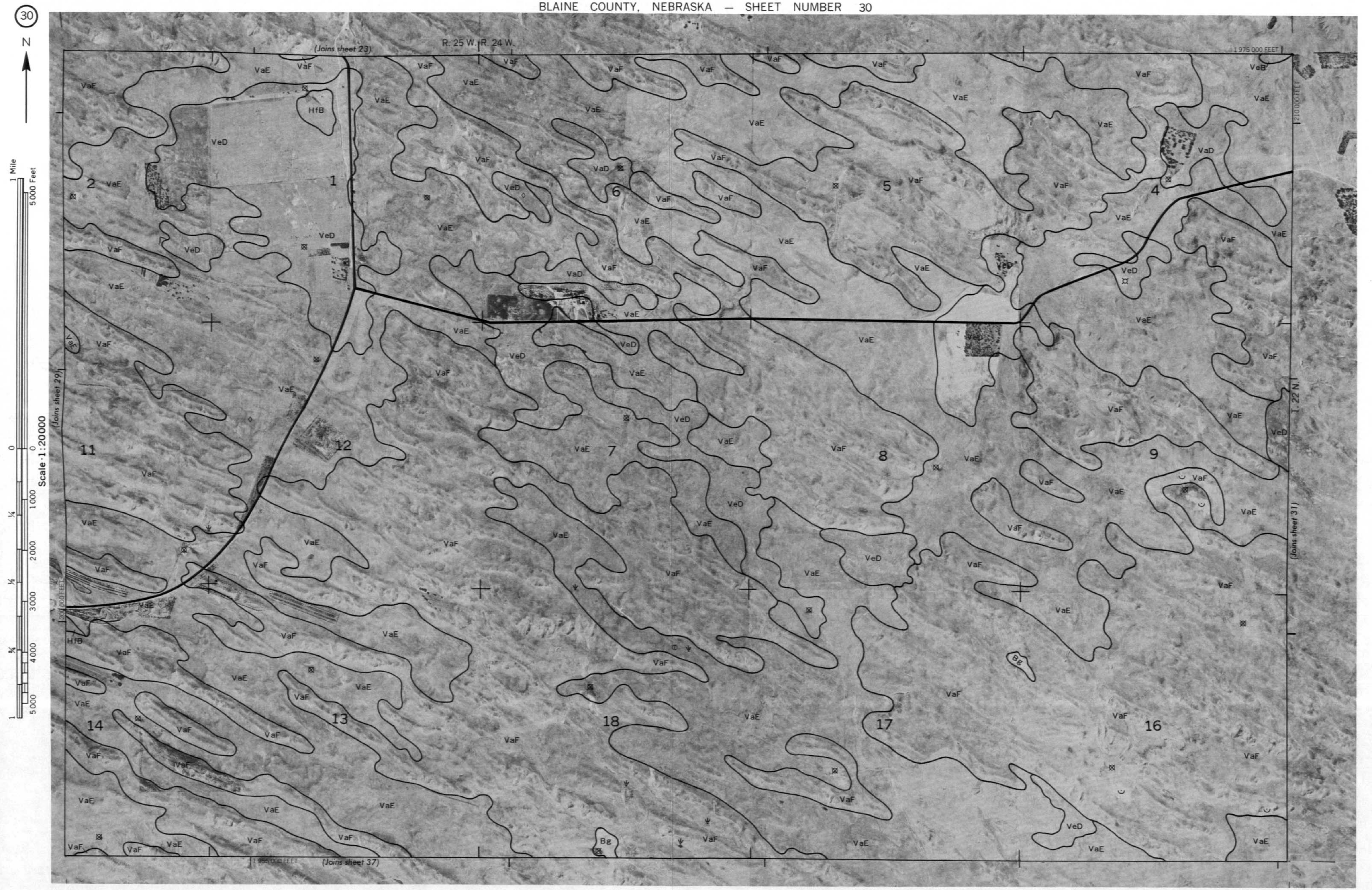

26
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 19)
R. 22 W.
2 045 000 FEET
2 025 000 FEET
225 000 FEET
215 000 FEET
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 33)
T. 23 N.
NORTH LOUP RIVER
BREWSTER
(county seat)
BREWSTER CEMETERY
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35

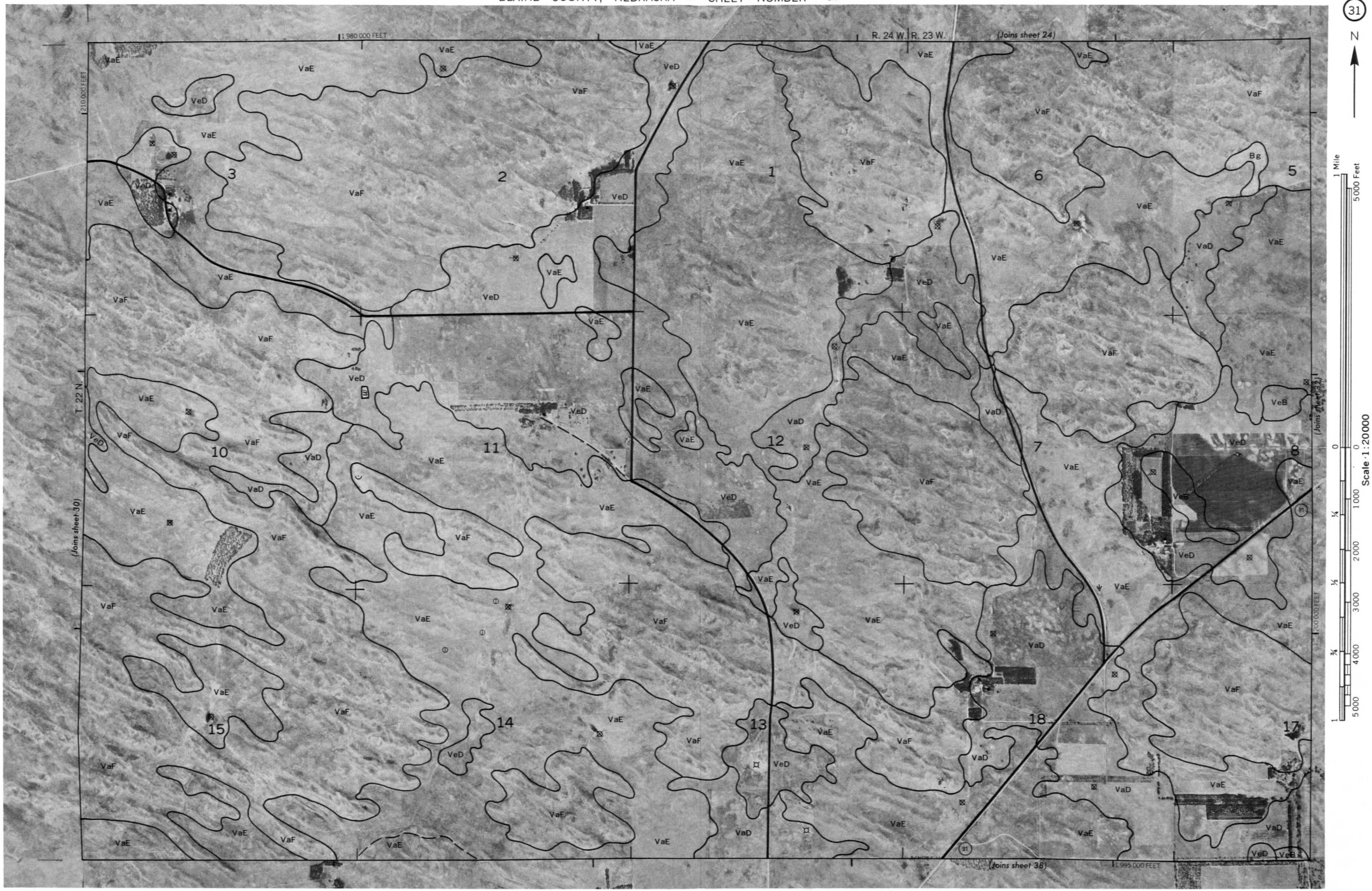

27
N
(Joins sheet 20)
R. 22 W.
R. 21 W.
2 050 000 FEET
T. 23 N.
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 34)
2 065 000 FEET
NORTH LOUP RIVER
LOUP RIVER
1 Mile
5000 Feet
Scale 1:20000
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
91

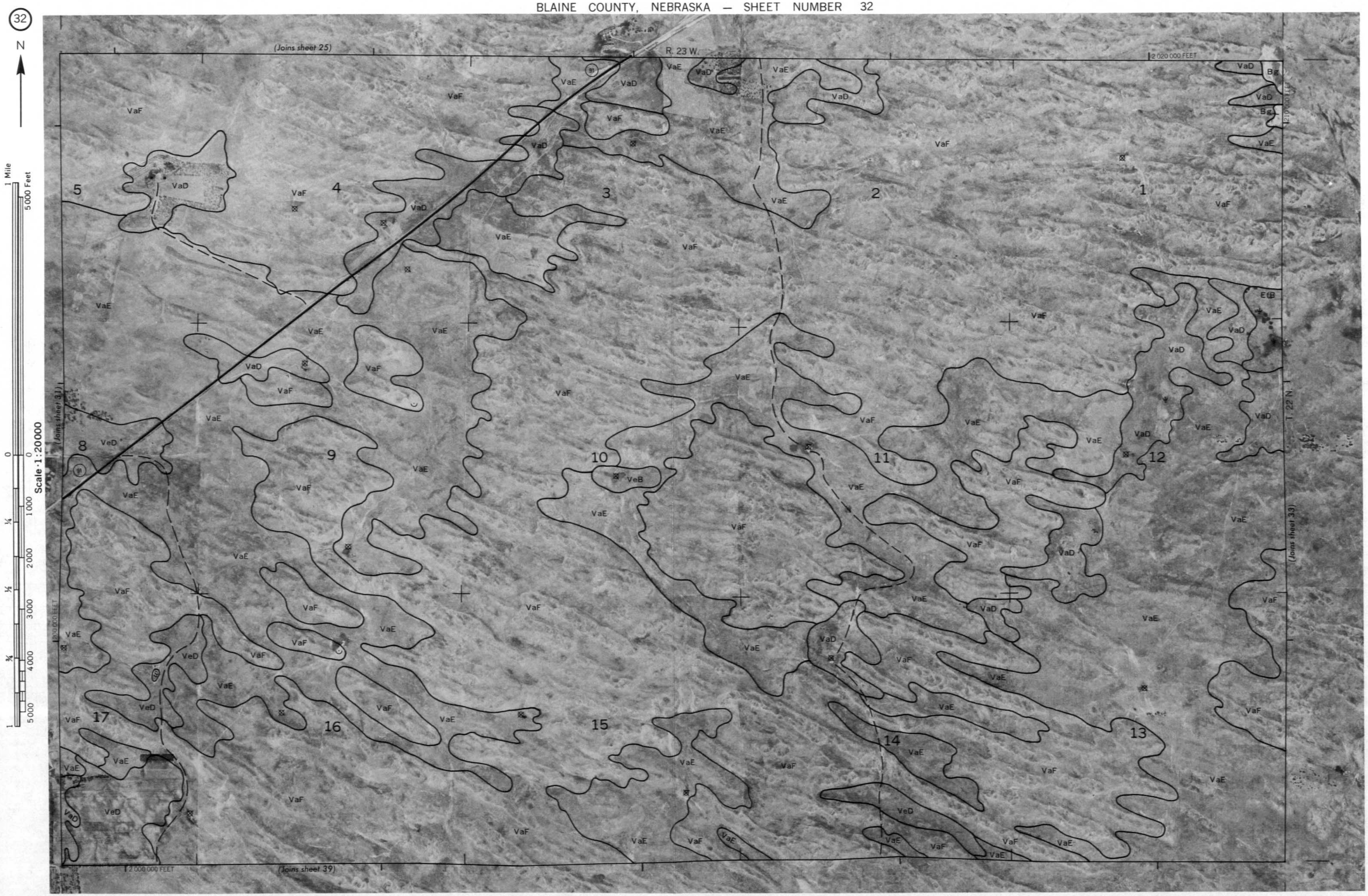

28
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 21)
R. 21 W.
2 085 000 FEET
(Joins sheet 27)
(Joins sheet 35)
2 070 000 FEET
225 000 FEET
T. 23 N.
PLEASANT
VALLEY
NORTH LOUP RIVER
LOUP
RIVER
LOUP COUNTY
22
23
24
25
26
27
34
35
36

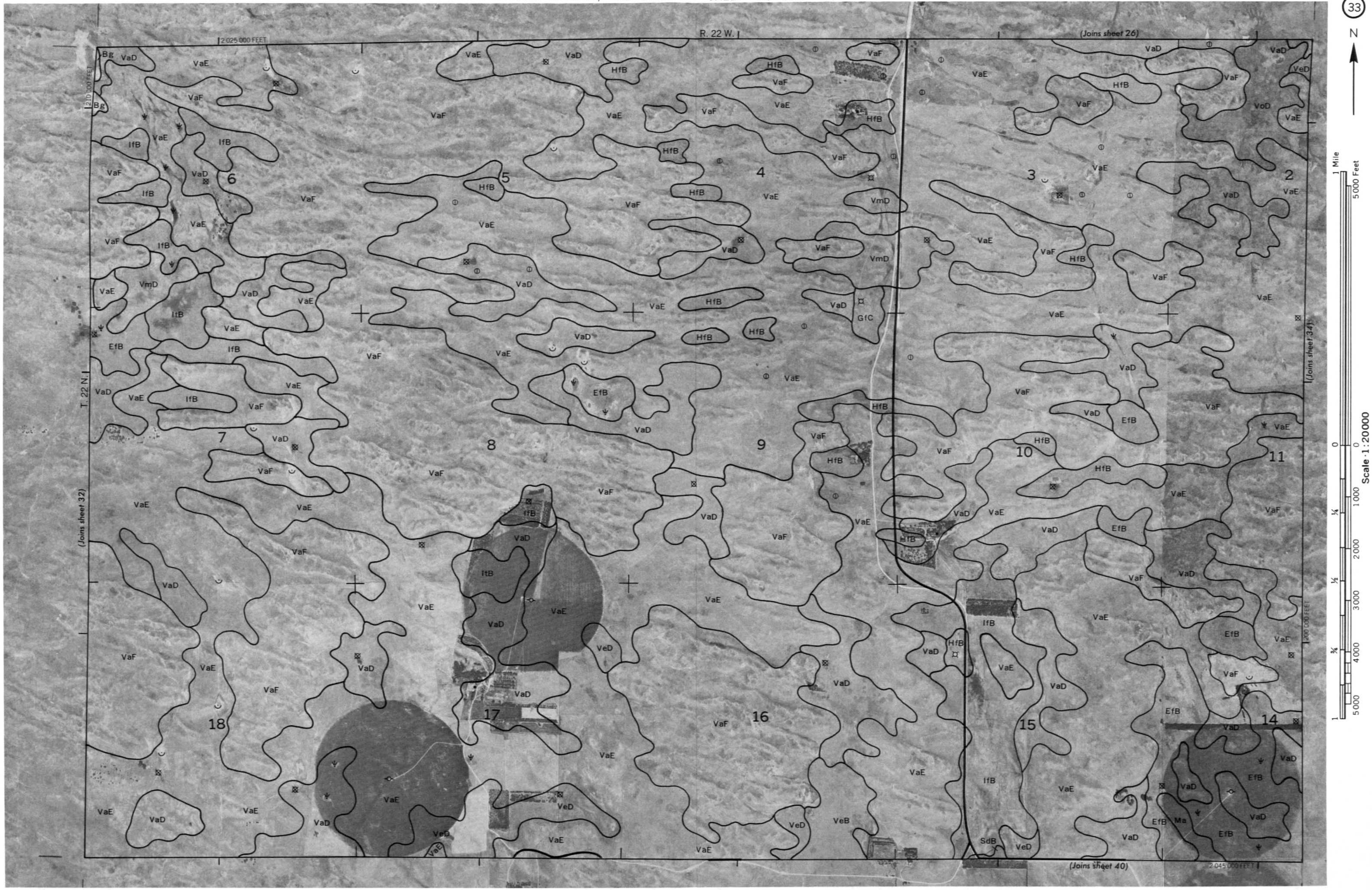
29

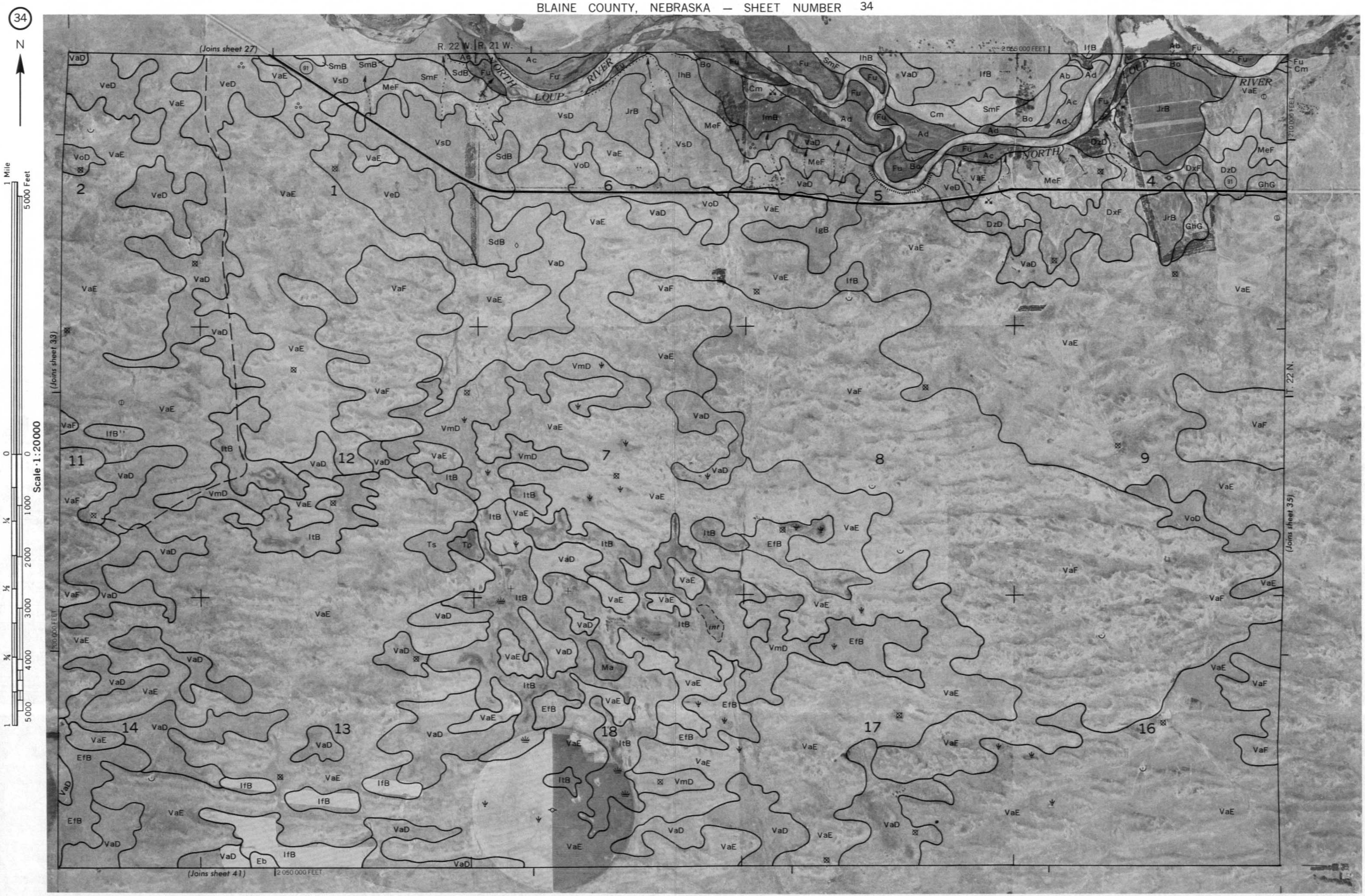

N
R. 25 W.
1 930 000 FEET
210 000 FEET
(Joins sheet 22)
(Joins sheet 30)
(Joins sheet 36)
1 950 000 FEET
T. 22 N.
THOMAS COUNTY
Halsey
MIDDLE LOUP RIVER
BURLINGTON NORTHERN
NEBRASKA NATIONAL FOREST
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18
VaE
VaF
VaD
VoD
VeD
VmD
IfB
IhB
HfB
EfB
SdB
Ab
Ad
Bo
Cm
1 Mile
5000 Feet
Scale 1:20000


30
N
(Joins sheet 23)
R. 25 W. R. 24 W.
1 975 000 FEET
210 000 FEET
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 37)
T. 22 N.
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
VaE
VaF
VaD
VeD
VeB
HfB
Bg

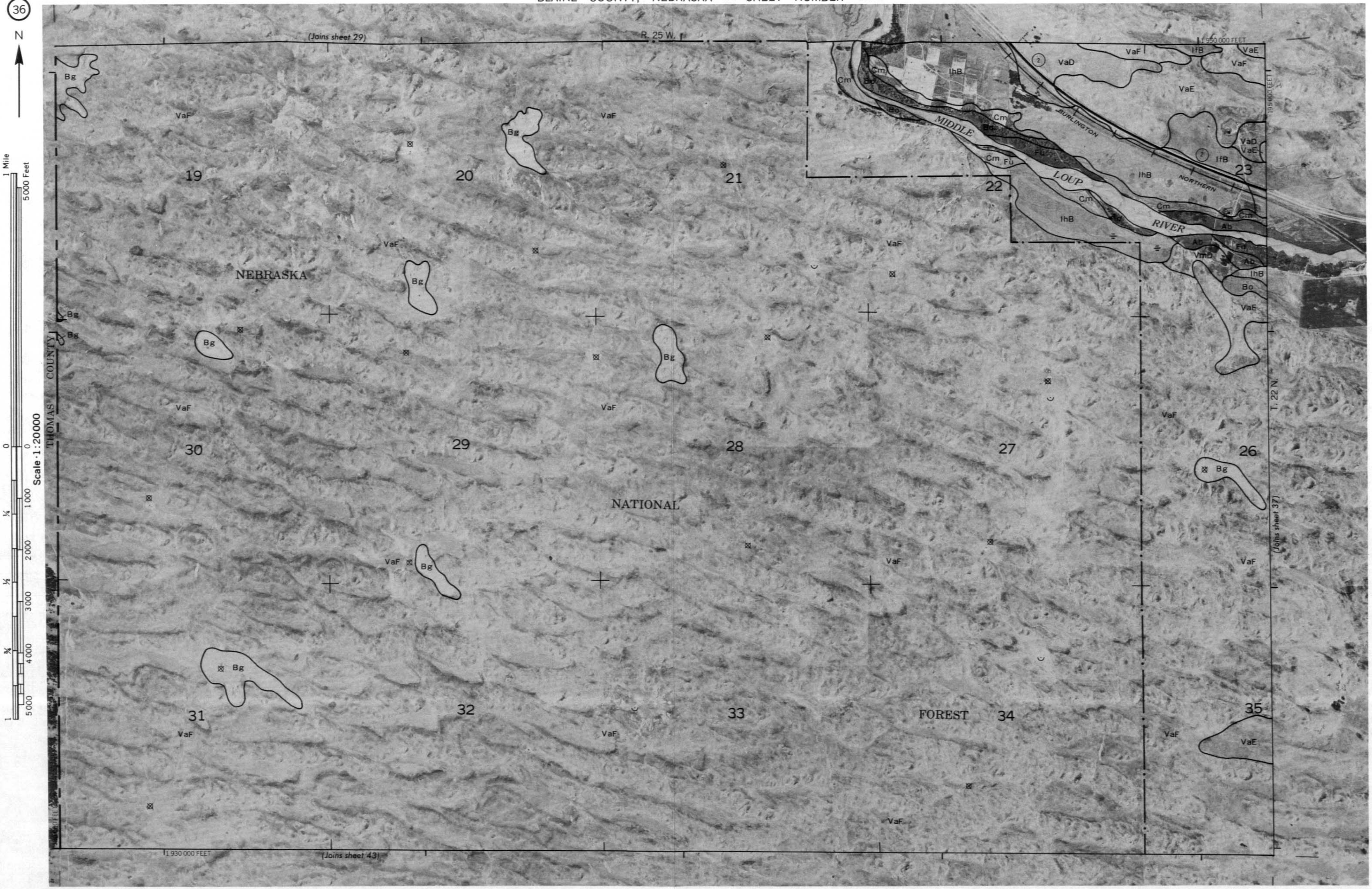

31
N
(Joins sheet 24)
(Joins sheet 30)
(Joins sheet 32)
(Joins sheet 38)
R. 24 W. R. 23 W.
T. 22 N.
1 980 000 FEET
210 000 FEET
200 000 FEET
1 995 000 FEET
1 Mile
5000 Feet
Scale 1:20000
VaE
VaF
VaD
VeD
VeB
Bg
1
2
3
5
6
7
8
10
11
12
13
14
15
17
18
91

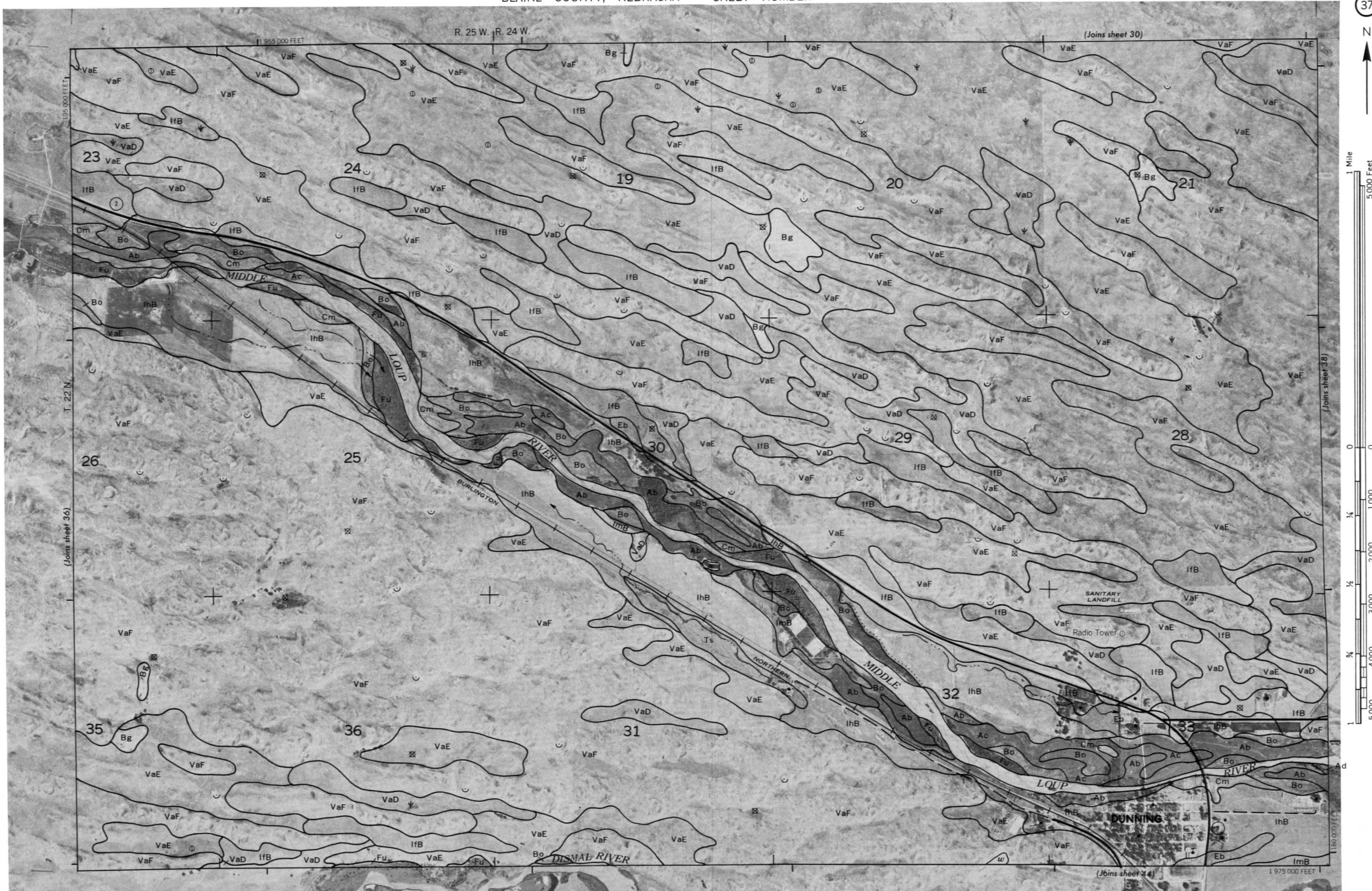

32
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 25)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 39)
R. 23 W.
T. 22 N.
2 020 000 FEET
2 000 000 FEET
VaF
VaE
VaD
VeD
VeB
EtB
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17

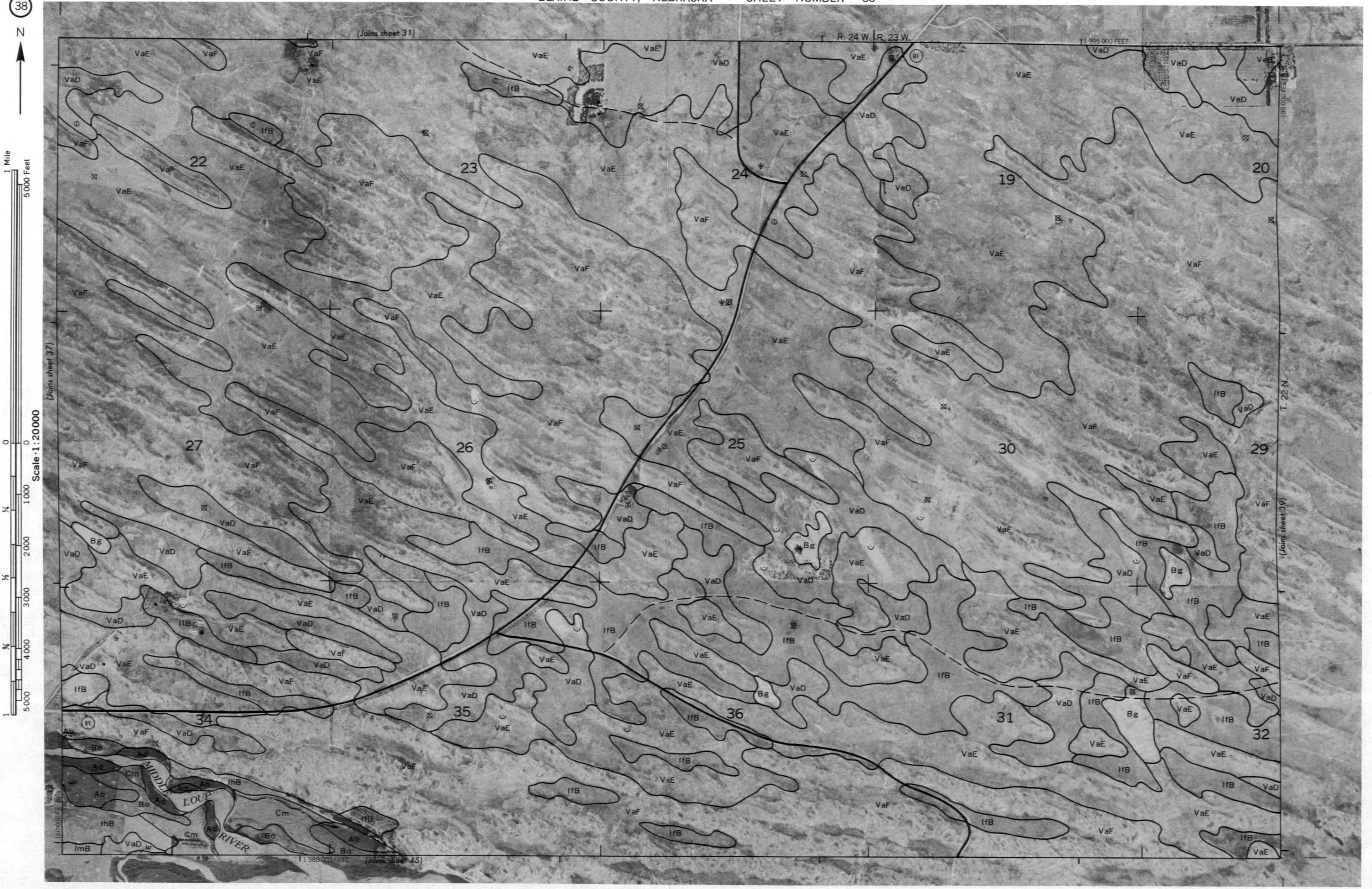

33
N
R. 22 W.
T. 22 N.
(Joins sheet 26)
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 40)
2 025 000 FEET
2 045 000 FEET
210 000 FEET
200 000 FEET
1 Mile
5000 Feet
Scale 1:20000
1
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18
VaD
VaE
VaF
VeD
VeB
VmD
HfB
IfB
ItB
EfB
GfC
SdB
Ma
Bg

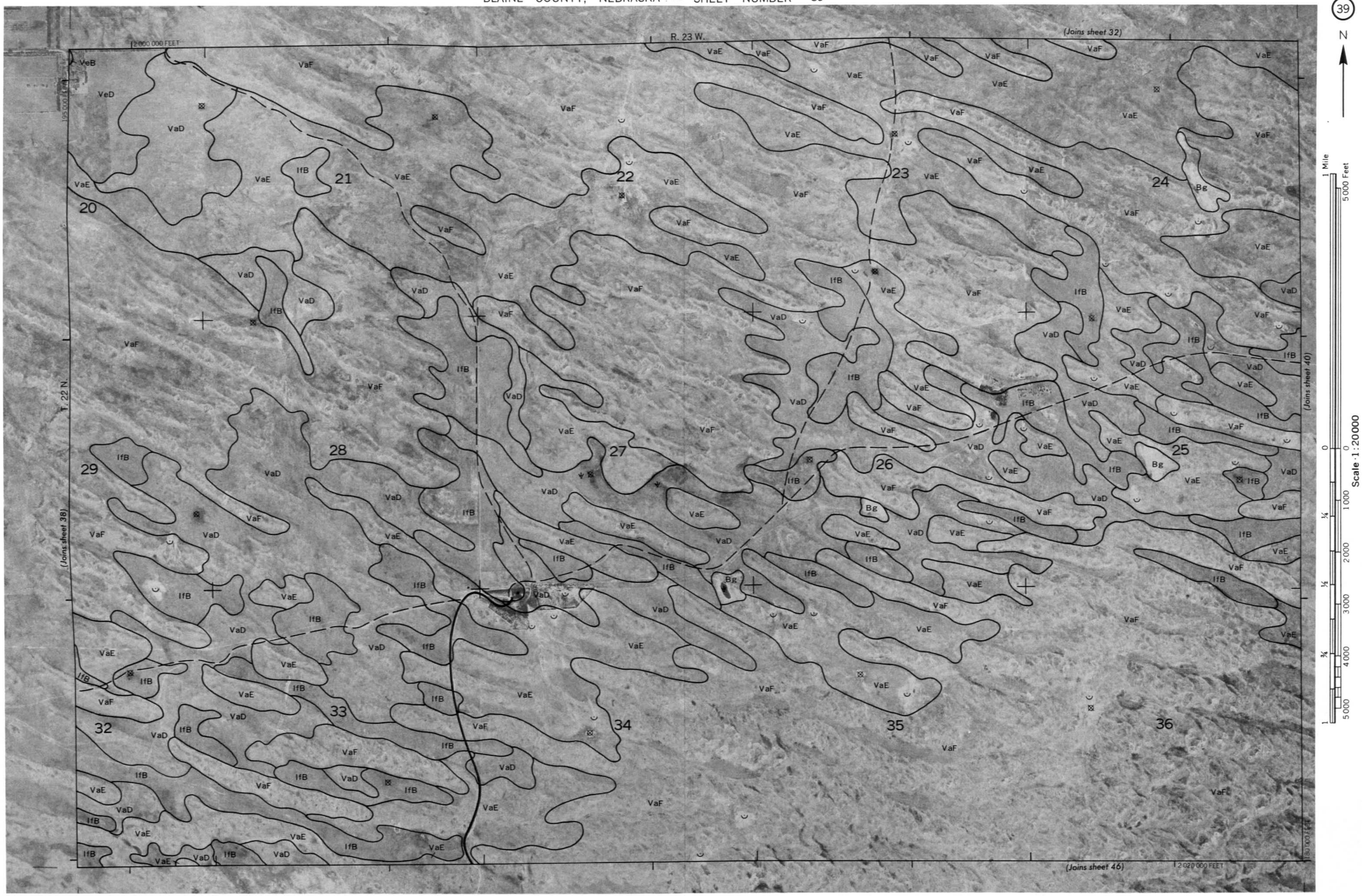

34
N
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 41)
R. 22 W.
R. 21 W.
T. 22 N.
2 055 000 FEET
2 050 000 FEET
NORTH LOUP RIVER
NORTH LOUP RIVER
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
VaE
VaD
VaF
VeD
VoD
VsD
VmD
SmB
SmF
SdB
MeF
JrB
IfB
ItB
IgB
ImB
IhB
EfB
Eb
Fu
Cm
Ac
Ad
Ab
Bo
DzD
DxF
GhG
Ts
Tp
Ma

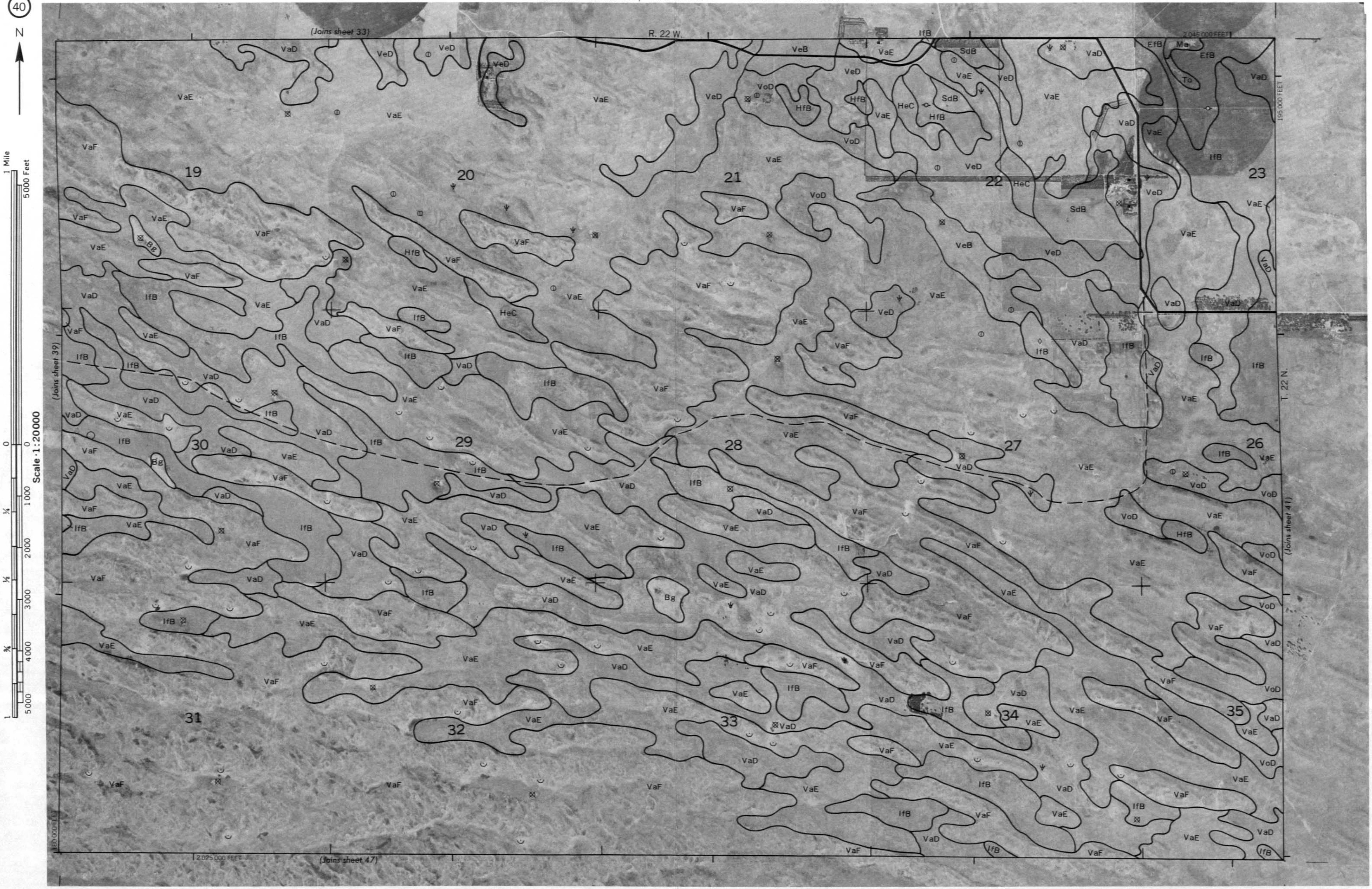

35
N
R. 21 W.
(Joins sheet 28)
T. 22 N.
(Joins sheet 34)
(Joins sheet 42)
LOUP COUNTY
2 070 000 FEET
2 085 000 FEET
1 Mile
5000 Feet
Scale 1:20000
1
2
3
10
11
12
13
14
15
Fu
Cm
VaE
MeF
DzD
VuC
SmB
VoD
JrB
VaD
VeB
IgB
HeC
GhG
HfB
IfB
VaF
VeD

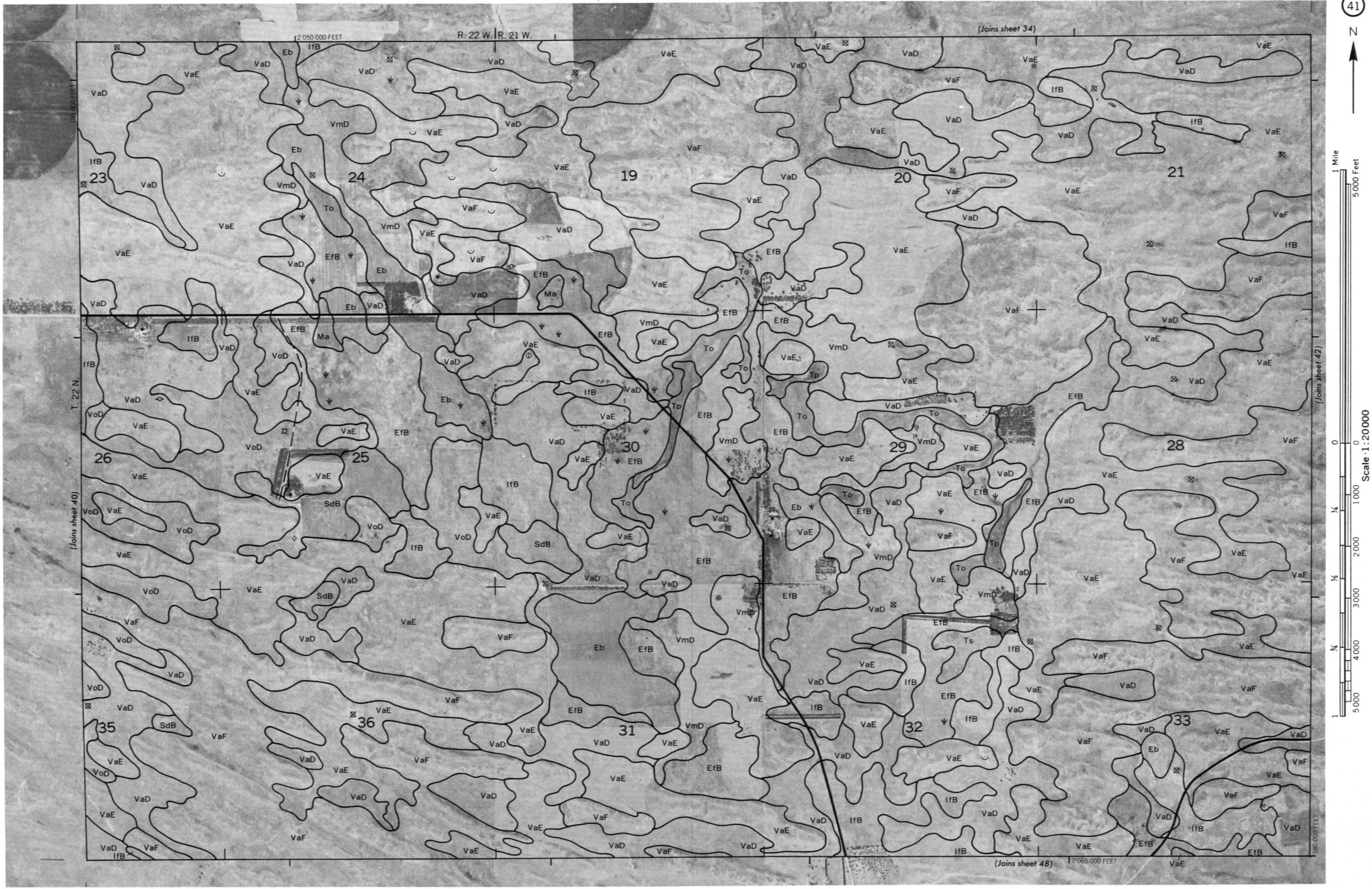

36
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 29)
R. 25 W.
(Joins sheet 43)
(Joins sheet 37)
T. 22 N.
1 930 000 FEET
THOMAS COUNTY
NEBRASKA
NATIONAL
FOREST
MIDDLE
LOUP
RIVER
BURLINGTON
NORTHERN
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35
Bg
VaF
VaE
VaD
IhB
IfB
Cm
Fu
Ab
Bo
VmB

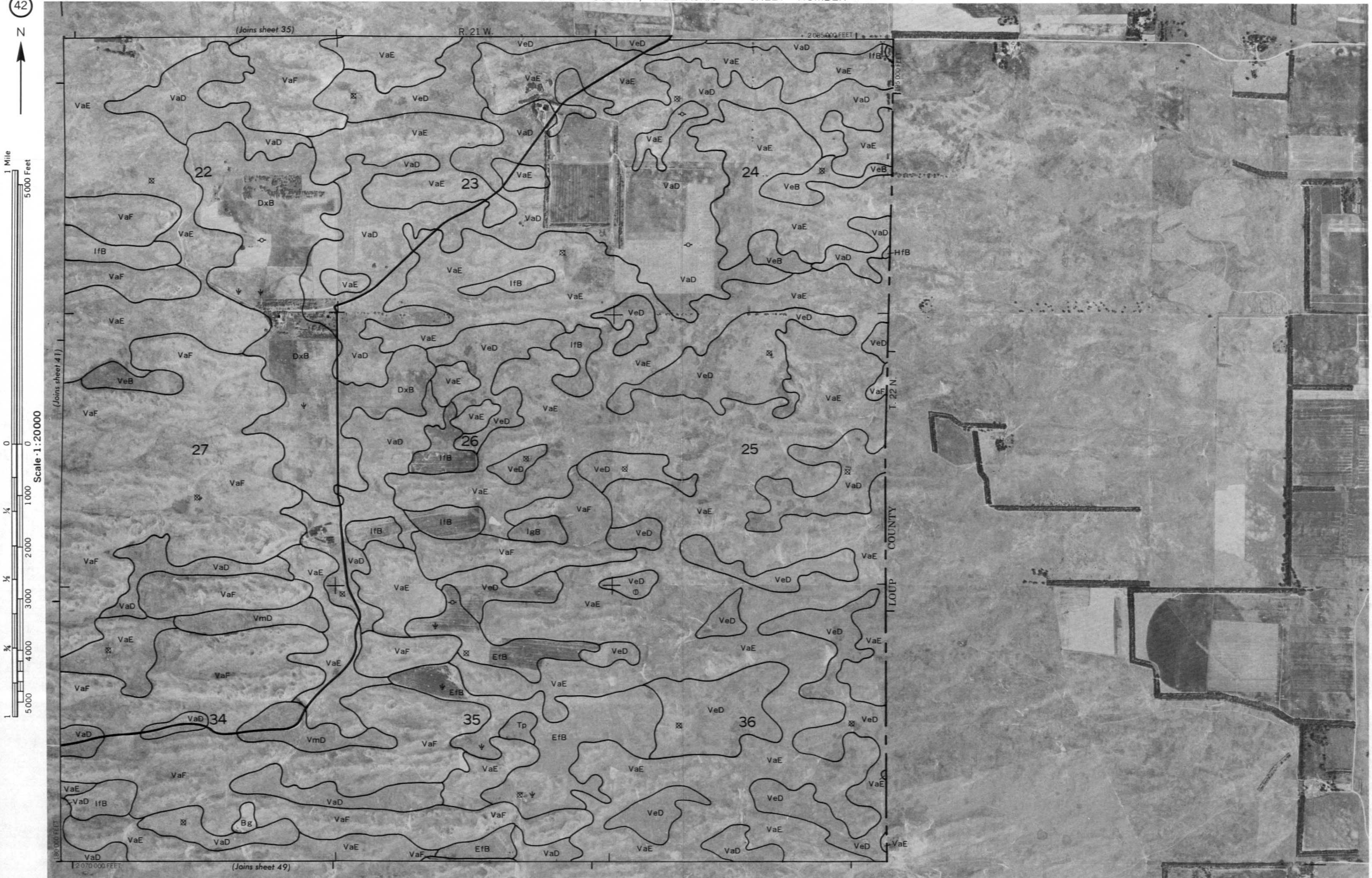

R. 25 W. R. 24 W.
1 955 000 FEET
(Joins sheet 30)
195 000 FEET
T. 22 N.
(Joins sheet 36)
(Joins sheet 38)
(Joins sheet 44)
1 975 000 FEET
180 000 FEET
MIDDLE LOUP RIVER
BURLINGTON NORTHERN
DISMAL RIVER
SANITARY LANDFILL
Radio Tower
DUNNING
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾

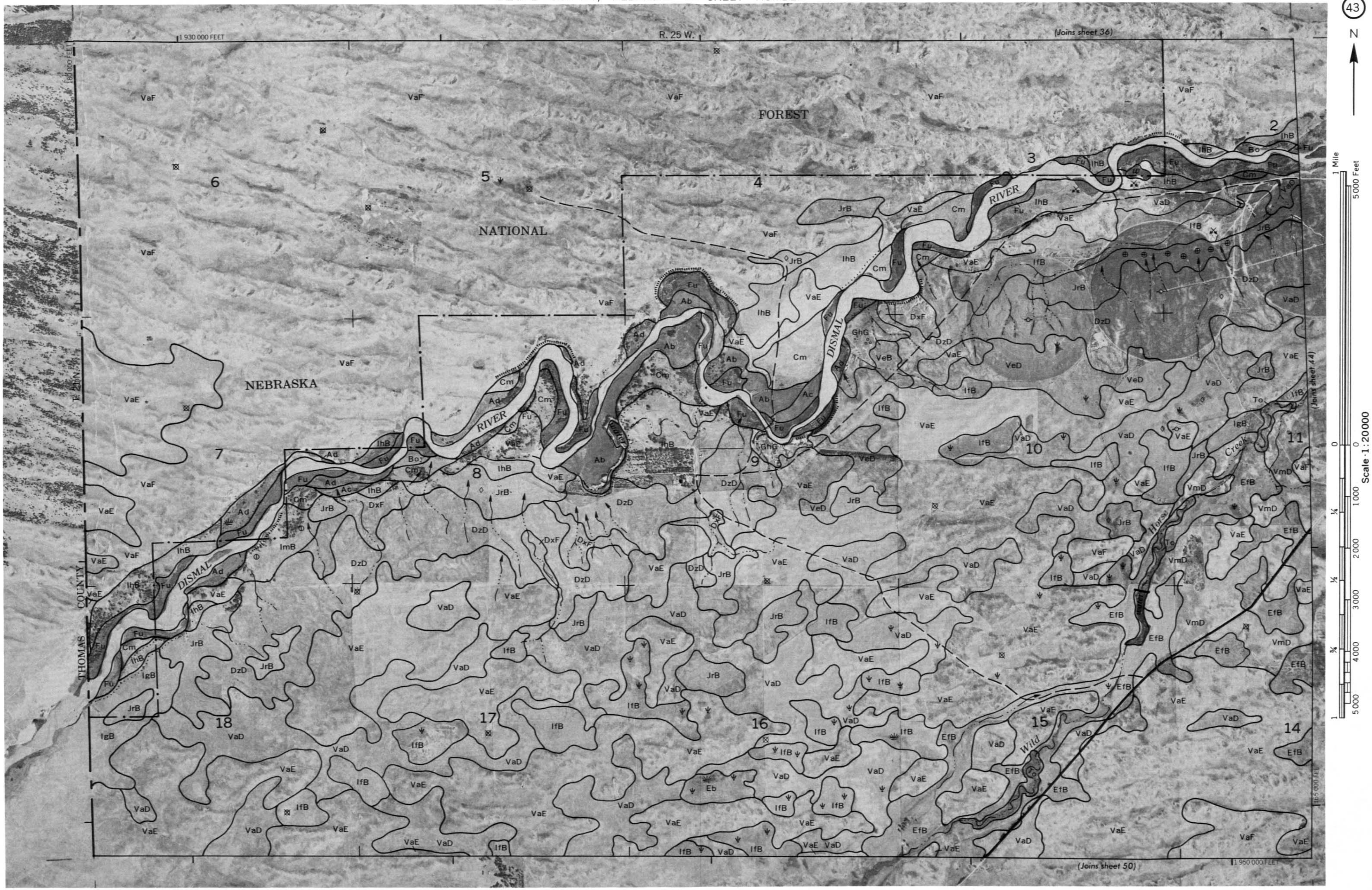

N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 31)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 45)
R. 24 W.
R. 23 W.
T. 22 N.
1 995 000 FEET
1 980 000 FEET
91
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32
VaE
VaF
VaD
VeD
IfB
Bg
Ab
Bo
Ad
Cm
IhB
ImB
MIDDLE LOUP RIVER


39
N
R. 23 W.
(Joins sheet 32)
T. 22 N.
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 46)
2 000 000 FEET
2 020 000 FEET
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
1 Mile
5000 Feet
Scale 1:20000

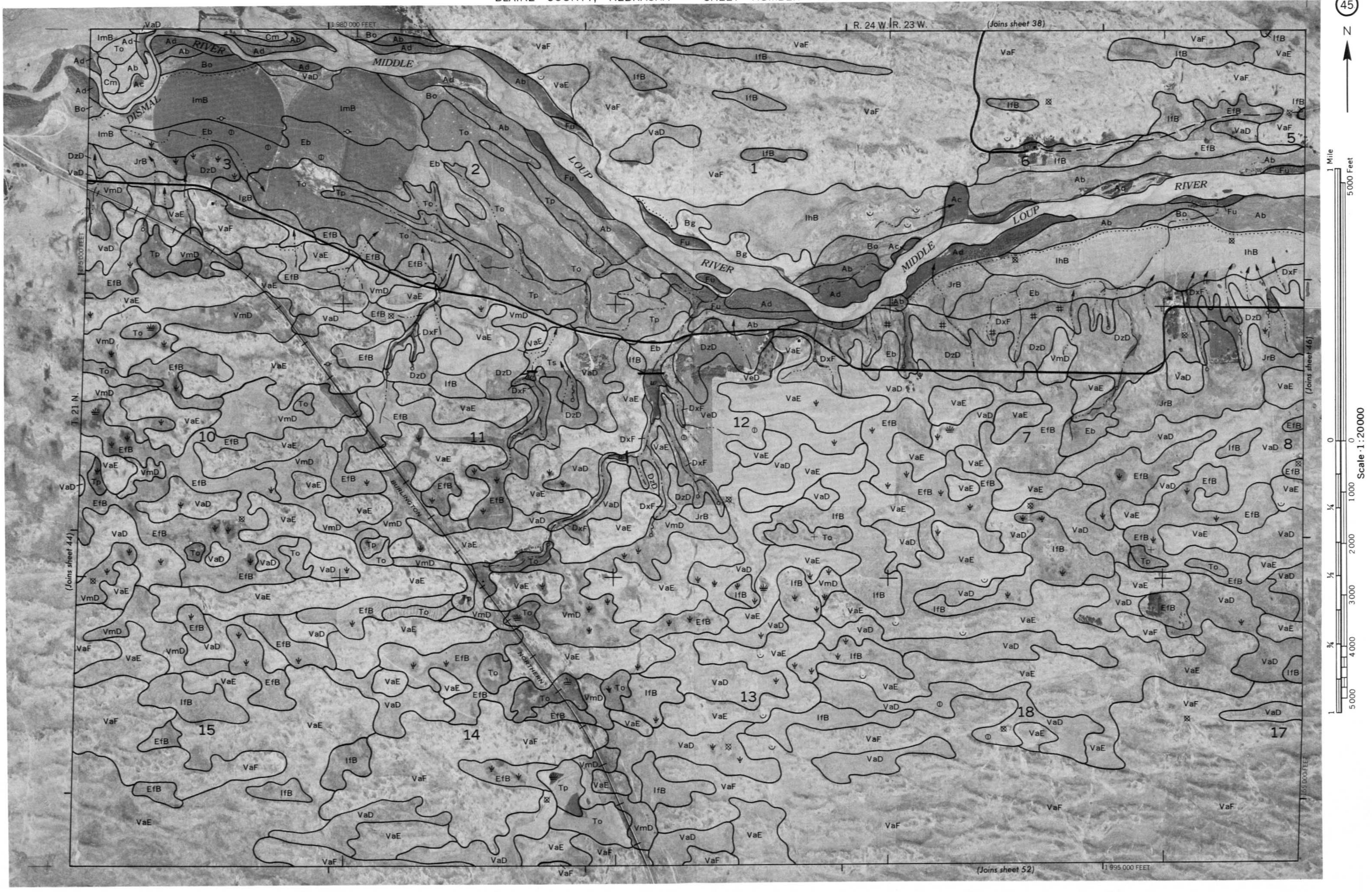

N
1 Mile
5 000 Feet
Scale 1:20 000
0
1000
2000
3000
4000
5000
(Joins sheet 33)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 47)
R. 22 W.
T. 22 N.
2 045 000 FEET
195 000 FEET
2 025 000 FEET
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
VaD
VaE
VaF
VeB
VeD
VoD
IfB
HfB
HeC
SdB
Bg
EfB
Me
To

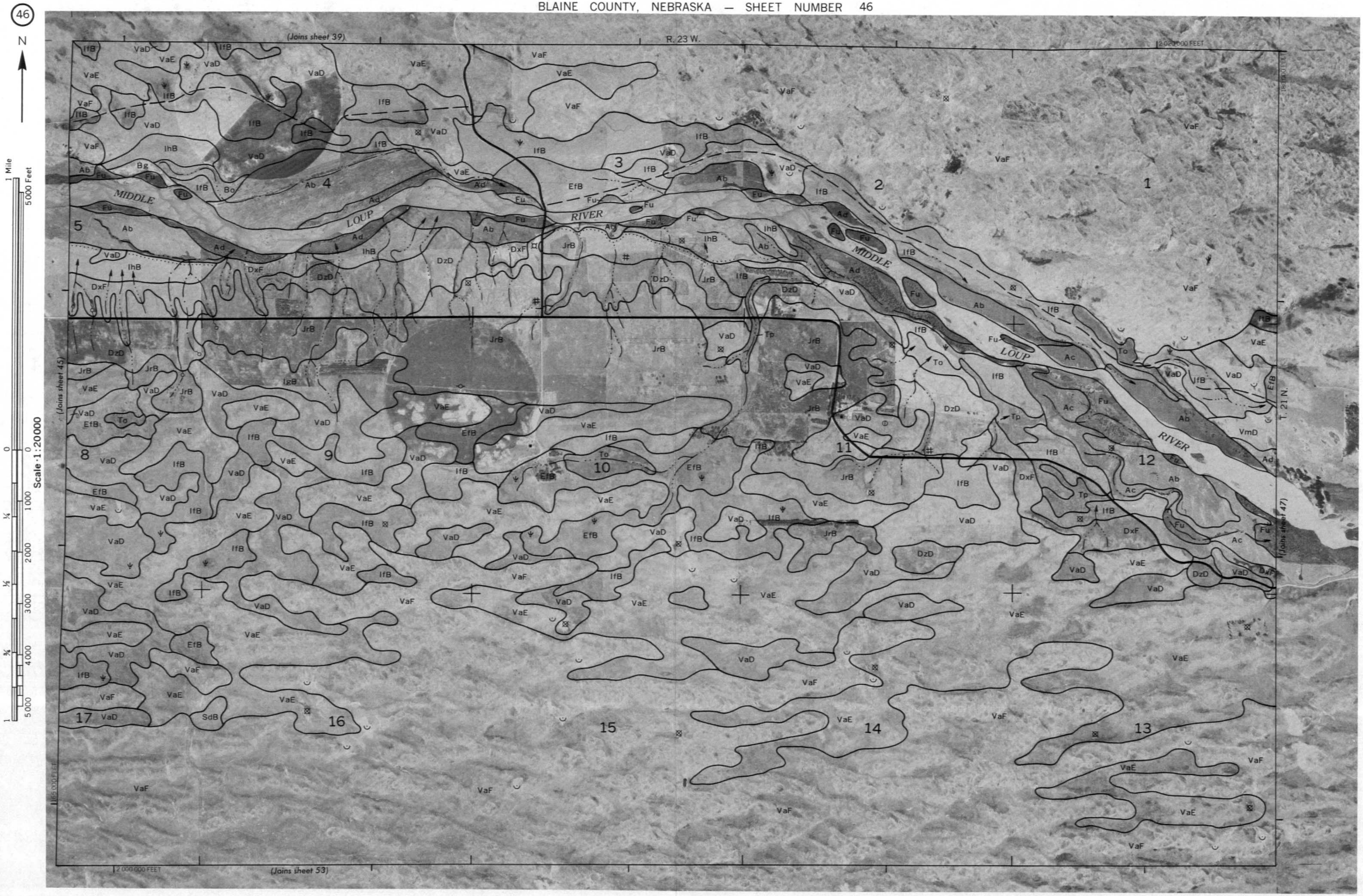

41
N
(Joins sheet 34)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 48)
R. 22 W. | R. 21 W.
T. 22 N.
2 050 000 FEET
2 065 000 FEET
185 000 FEET
180 000 FEET
1 Mile
5 000 Feet
Scale 1:20000
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

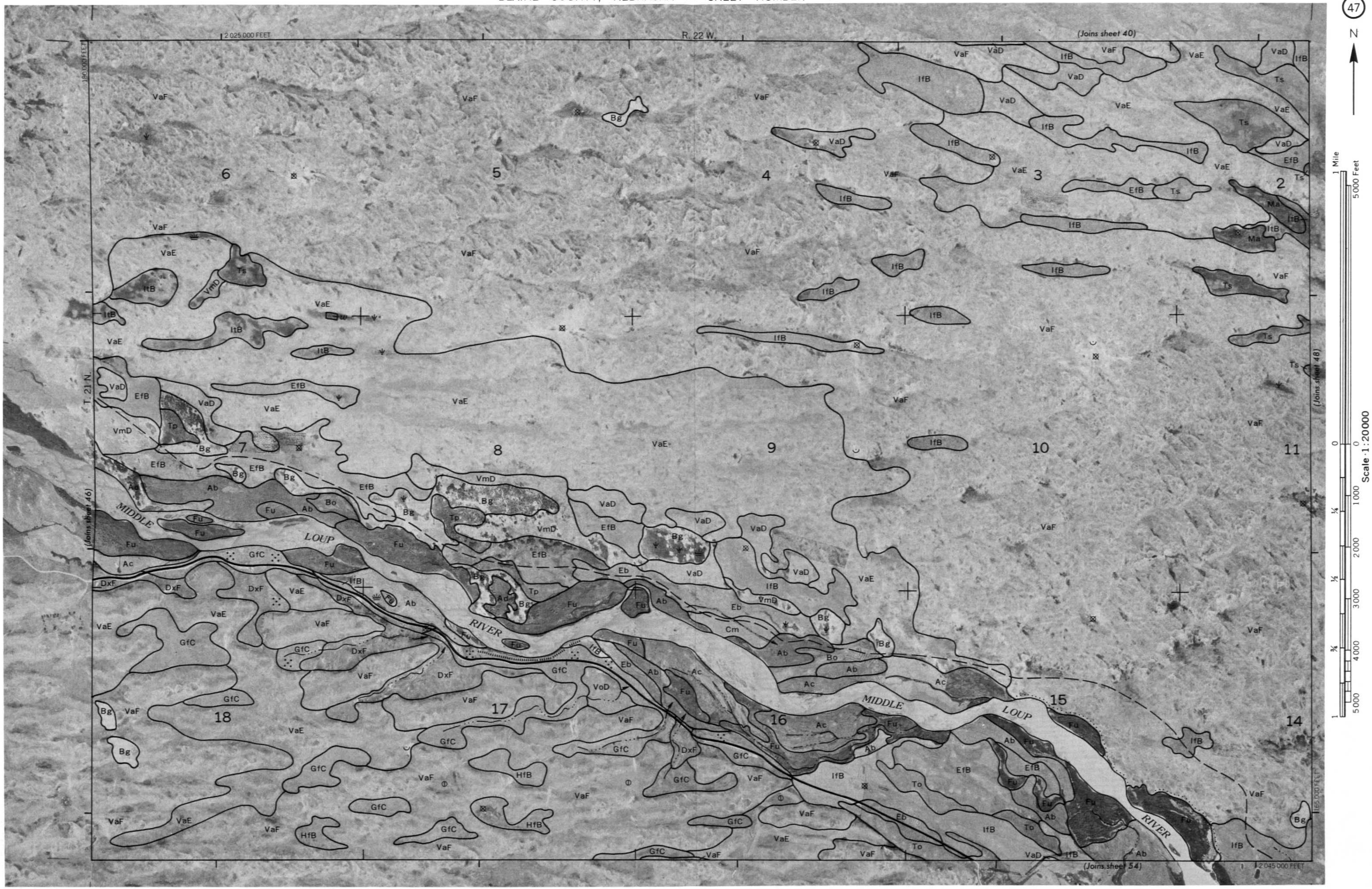

42
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 35)
R. 21 W.
2 085 000 FEET
(Joins sheet 41)
(Joins sheet 49)
2 070 000 FEET
T. 22 N.
LOUP COUNTY
22
23
24
25
26
27
34
35
36
VaD
VaE
VaF
VeB
VeD
IfB
HfB
DxB
IgB
EfB
VmD
Tp
Bg

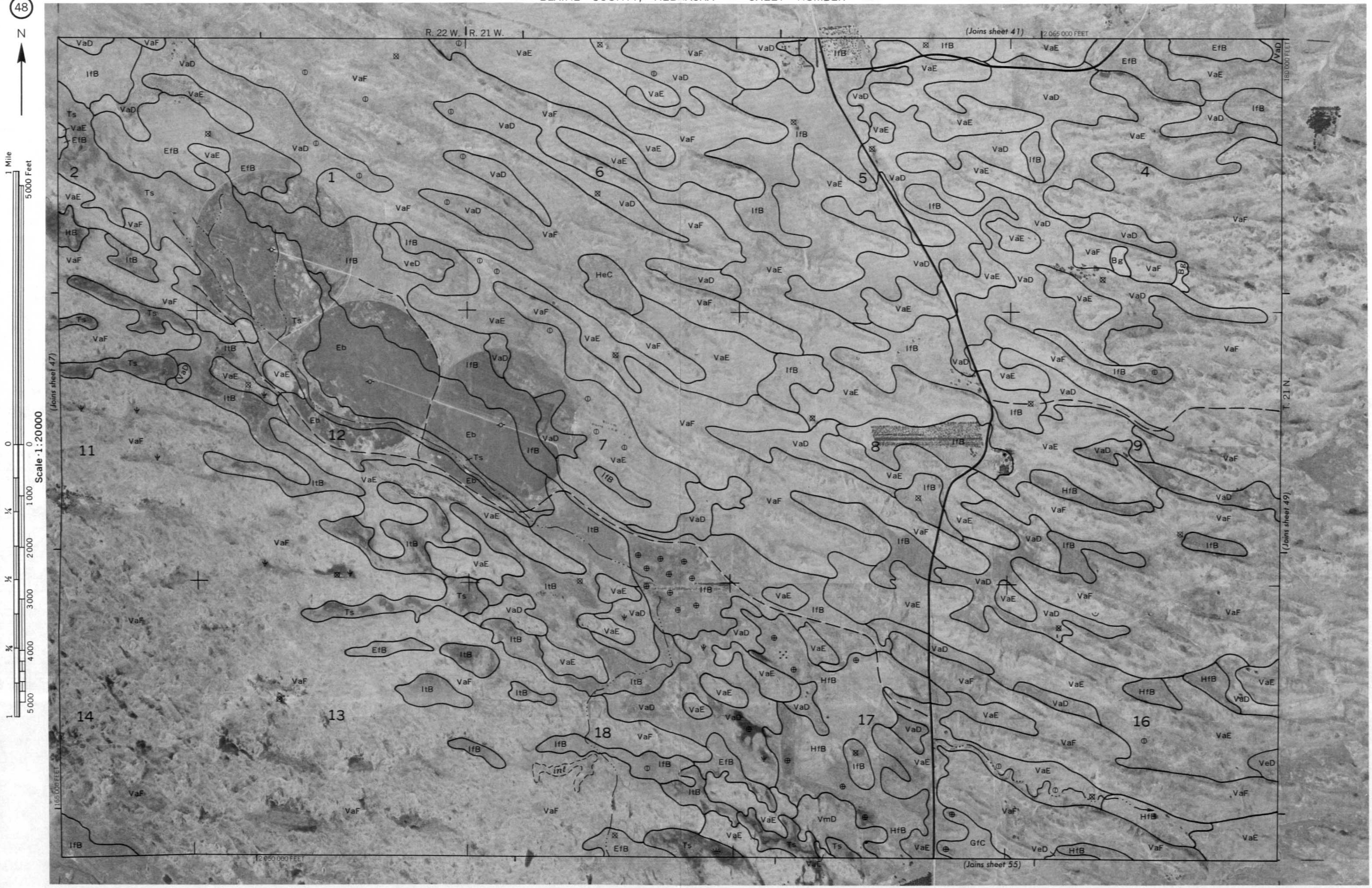

43
N
(Joins sheet 36)
1 930 000 FEET
R. 25 W.
FOREST
NATIONAL
NEBRASKA
DISMAL
RIVER
THOMAS COUNTY
Horse
Creek
Wild
(Joins sheet 44)
(Joins sheet 50)
1 950 000 FEET
1 Mile
5000 Feet
Scale 1:20000

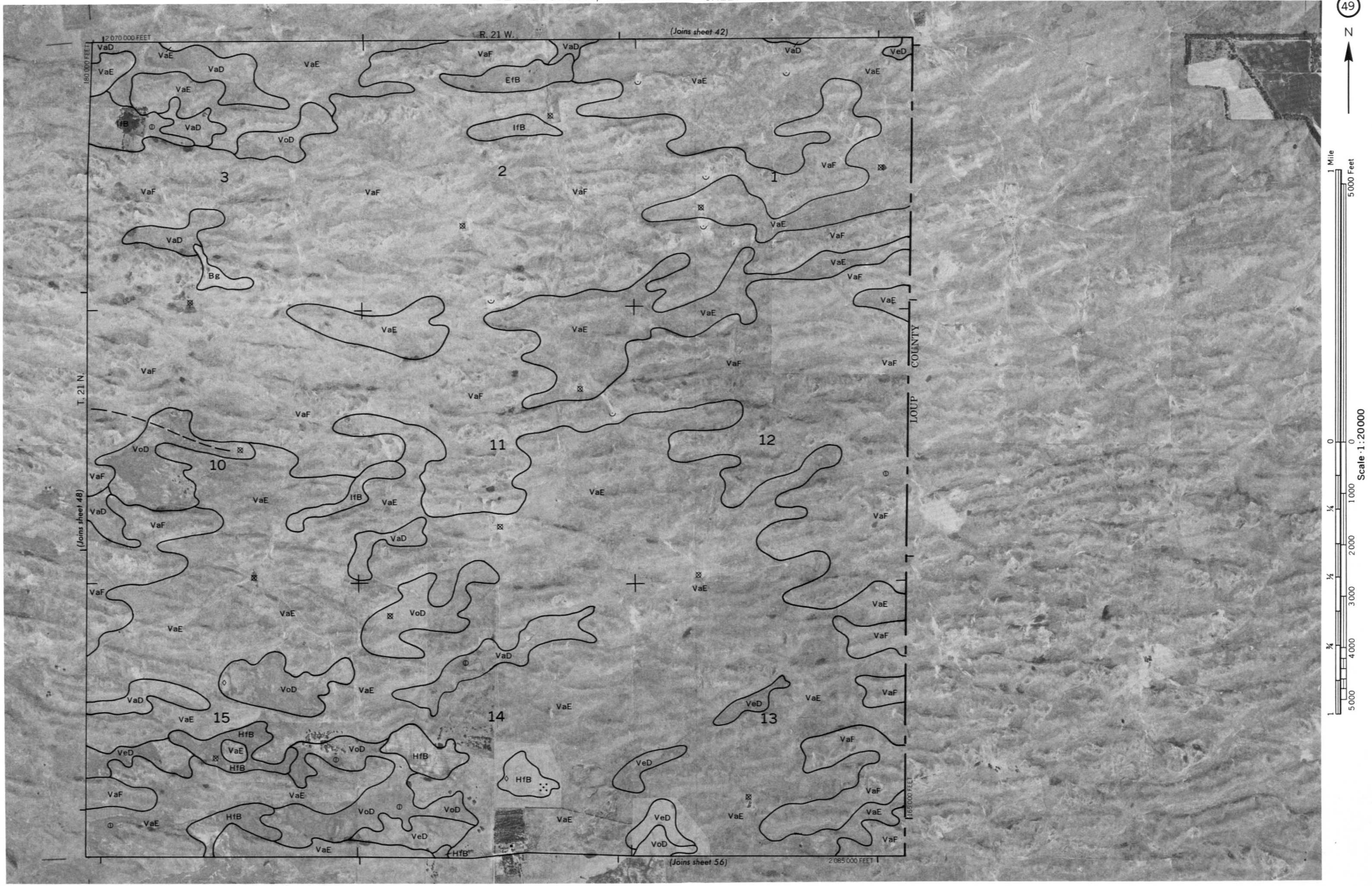

N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 37)
R. 25 W. R. 24 W.
1 975 000 FEET
DISMAL
RIVER
Wild Horse Creek
BURLINGTON NORTHERN
DUNNING
CEMETERY
T. 21 N.
175 000 FEET
(Joins sheet 43)
(Joins sheet 45)
165 000 FEET
1 955 000 FEET
(Joins sheet 51)
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18

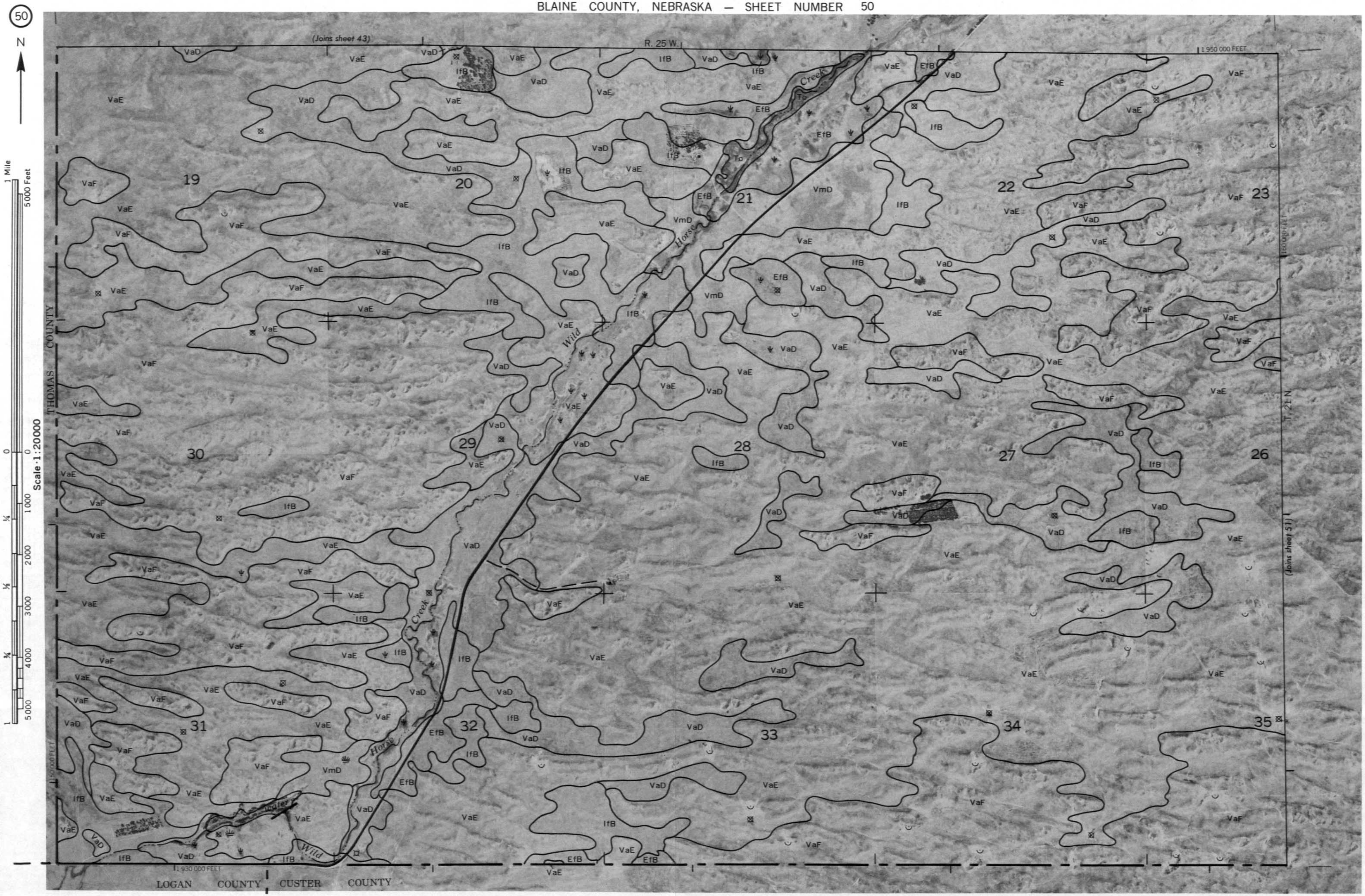

45
N
(Joins sheet 38)
(Joins sheet 46)
(Joins sheet 52)
(Joins sheet 44)
R. 24 W. R. 23 W.
T. 21 N.
1 980 000 FEET
1 995 000 FEET
DISMAL RIVER
MIDDLE LOUP RIVER
MIDDLE LOUP RIVER
BURLINGTON NORTHERN
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1


N
(Joins sheet 39)
R. 23 W.
2 020 000 FEET
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 53)
2 000 000 FEET
T. 21 N.
MIDDLE LOUP RIVER
MIDDLE LOUP RIVER
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000

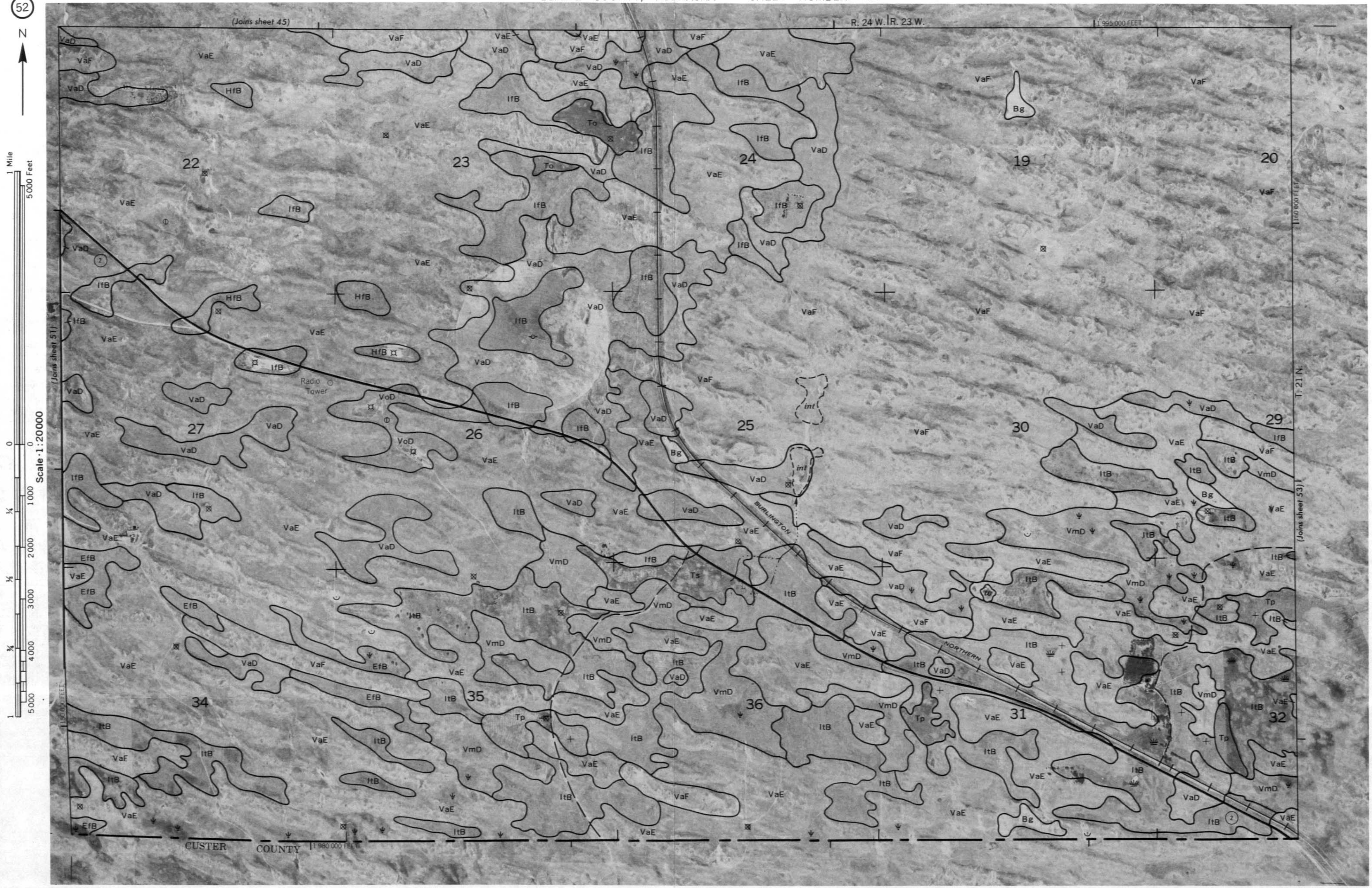

47
N
(Joins sheet 40)
(Joins sheet 46)
(Joins sheet 48)
(Joins sheet 54)
R. 22 W.
T. 21 N.
2 025 000 FEET
2 045 000 FEET
MIDDLE LOUP RIVER
1 Mile
5000 Feet
Scale 1:20000

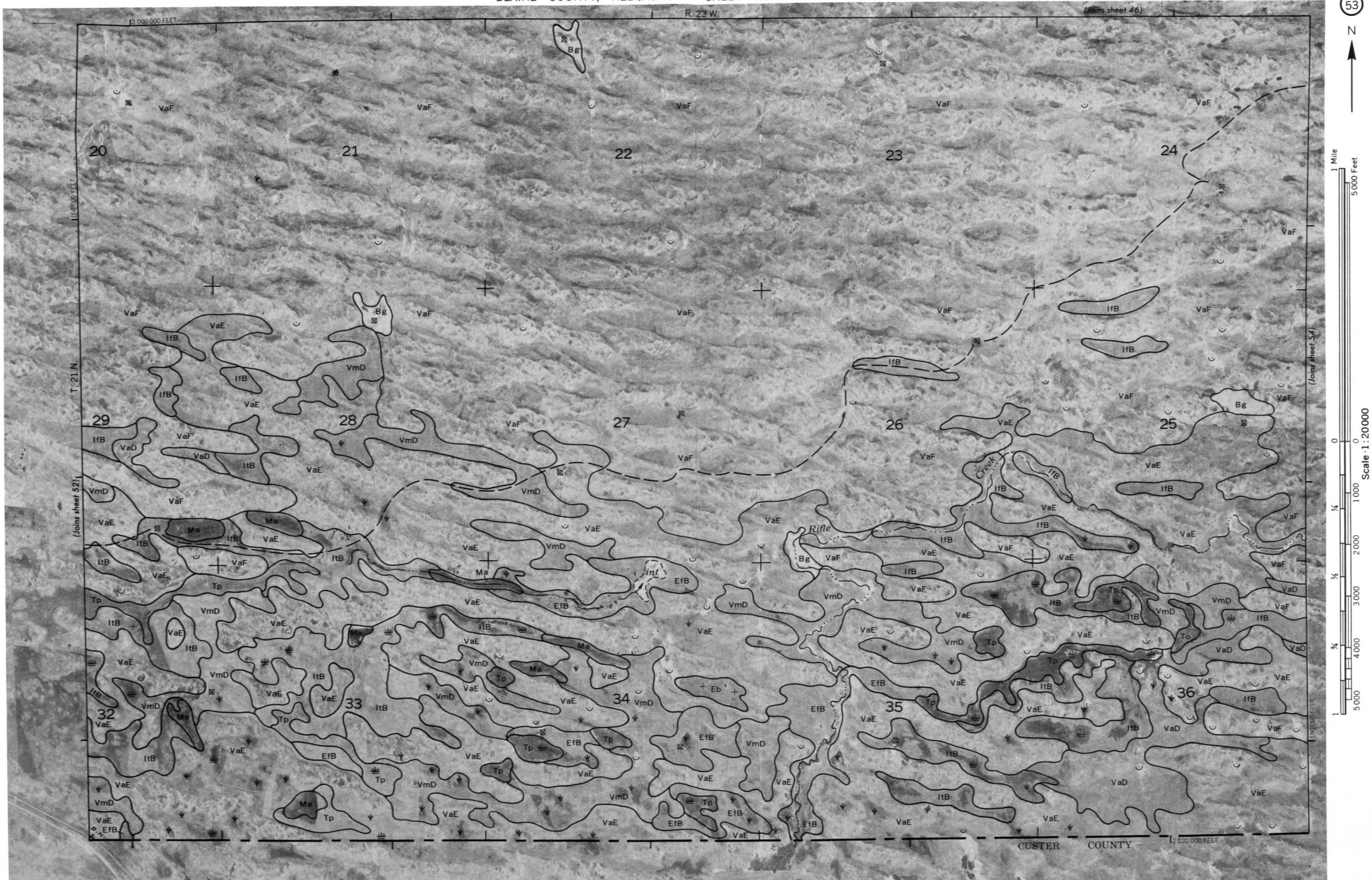

N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
R. 22 W.
R. 21 W.
(Joins sheet 41)
2 065 000 FEET
180 000 FEET
(Joins sheet 47)
(Joins sheet 49)
T. 21 N.
165 000 FEET
2 050 000 FEET
(Joins sheet 55)

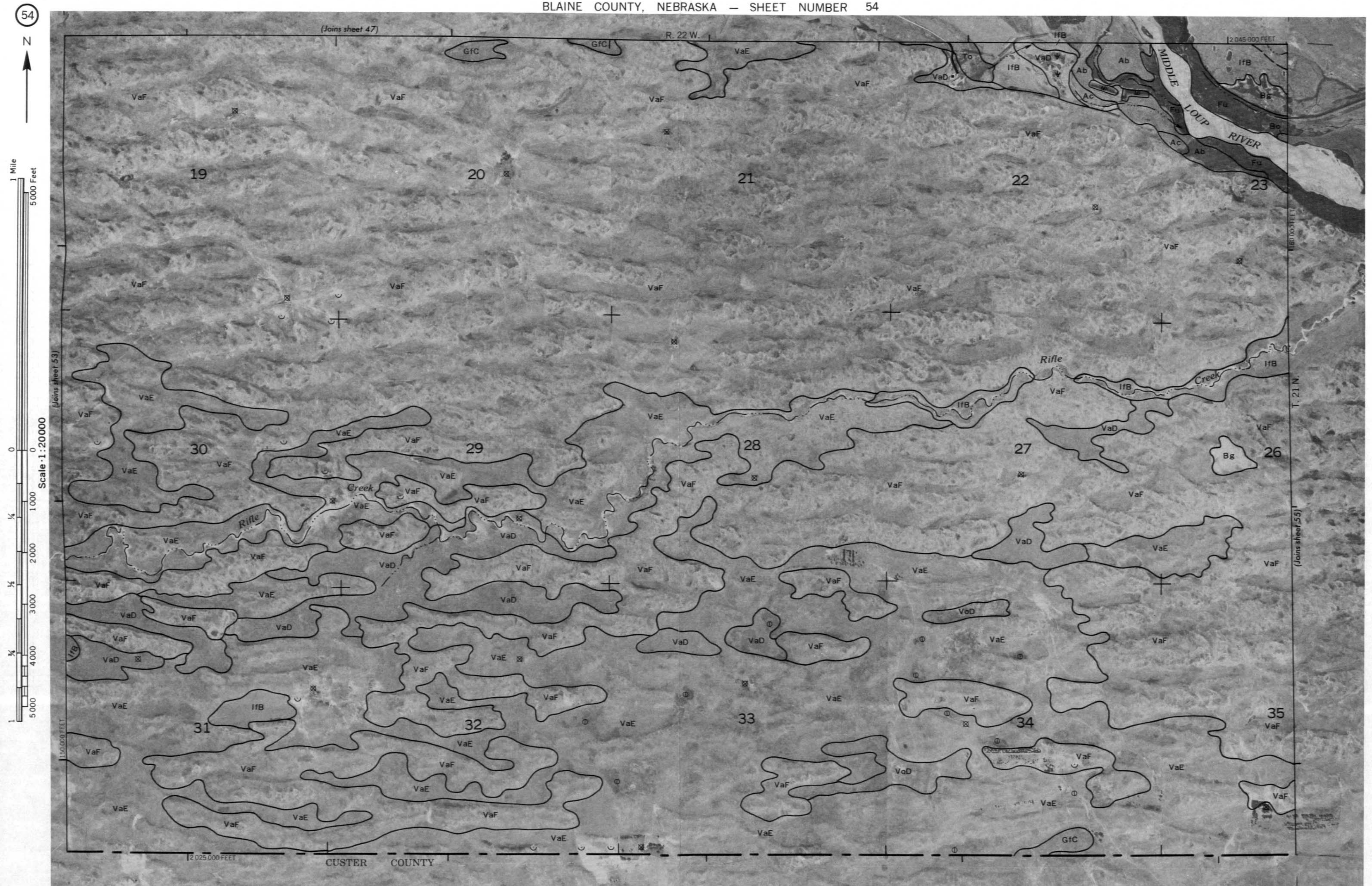

49
N
(Joins sheet 42)
R. 21 W.
2 070 000 FEET
180 000 FEET
T. 21 N.
(Joins sheet 48)
LOUP COUNTY
(Joins sheet 56)
2 085 000 FEET
165 000 FEET
1 Mile
5000 Feet
Scale 1:20000
1
2
3
10
11
12
13
14
15
VaD
VaE
VaF
VeD
VoD
EfB
IfB
HfB
Bg

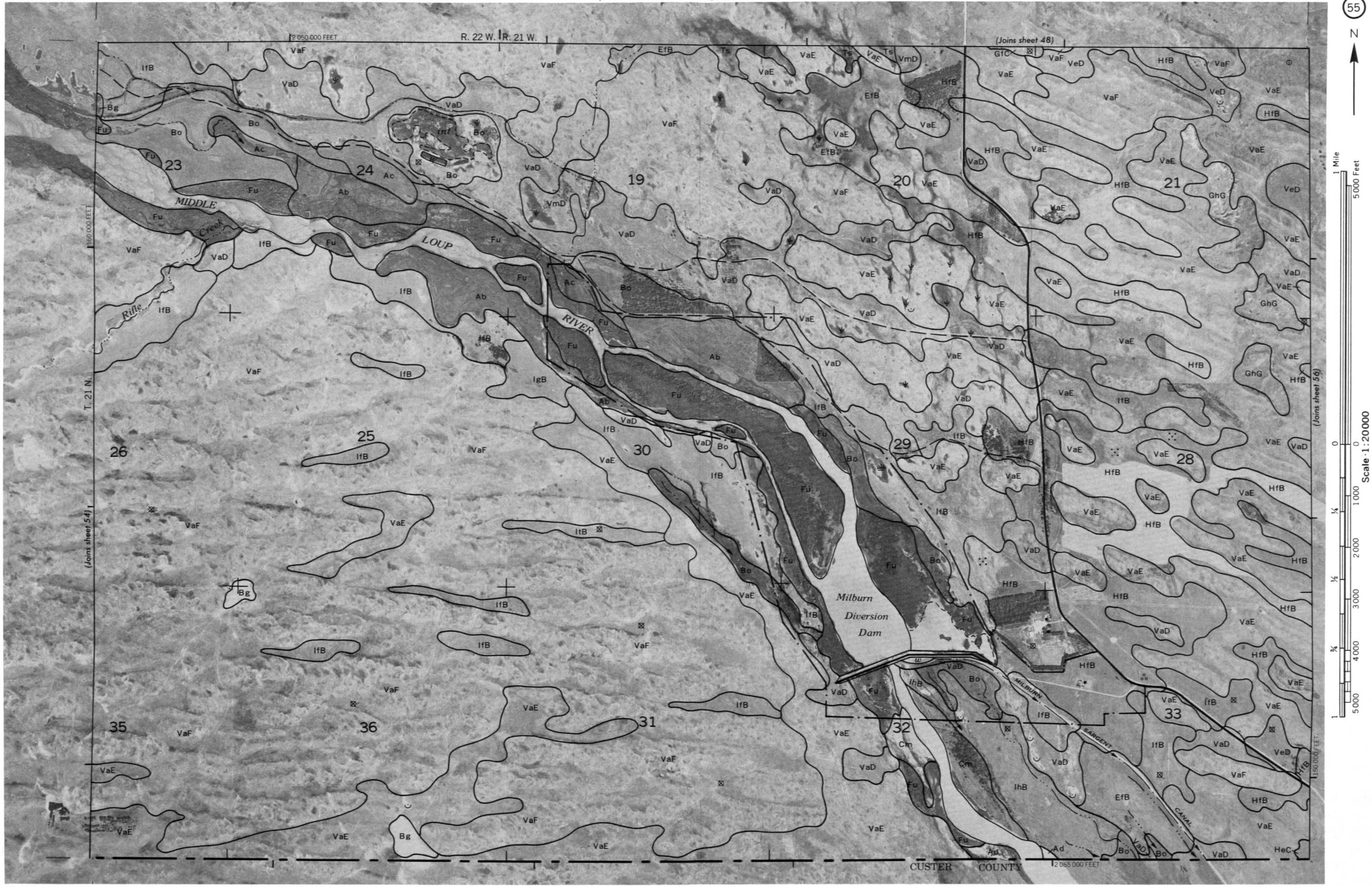

50
N
(Joins sheet 43)
R. 25 W.
1 950 000 FEET
T. 21 N.
(Joins sheet 51)
THOMAS COUNTY
LOGAN COUNTY
CUSTER COUNTY
1 930 000 FEET
Scale 1:20000
1 Mile
5000 Feet
Wild Horse Creek
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
VaD
VaE
VaF
IfB
EfB
VmD
To

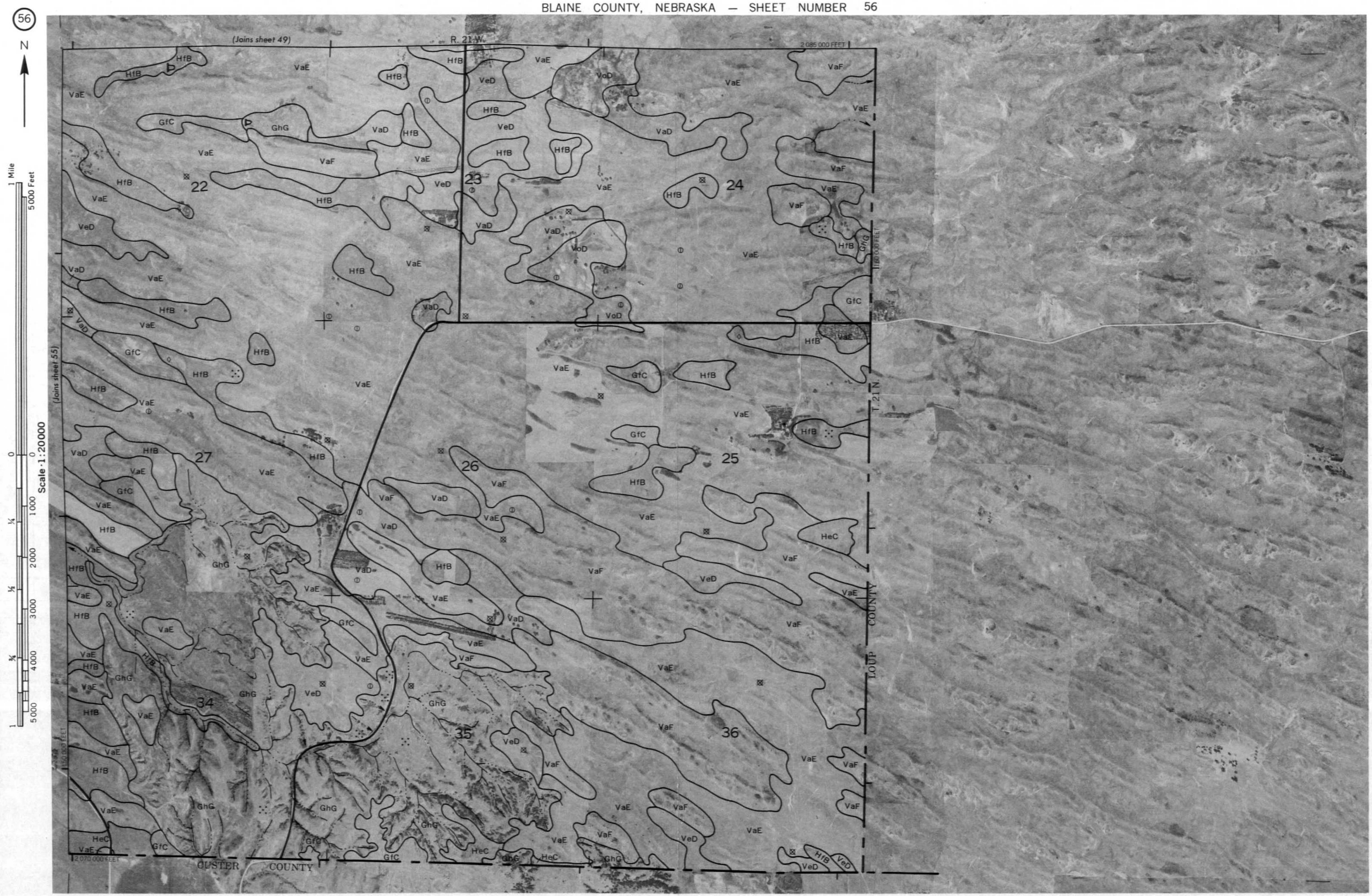
BLAINE COUNTY, NEBRASKA — SHEET NUMBER 51


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 45)
R. 24 W.
R. 23 W.
1 995 000 FEET
(Joins sheet 51)
(Joins sheet 53)
T. 21 N.
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32
Radio Tower
BURLINGTON
NORTHERN
CUSTER
COUNTY
1 980 000 FEET


53
N
(Joins sheet 46)
(Joins sheet 52)
(Joins sheet 54)
2 000 000 FEET
2 020 000 FEET
R. 23 W.
T. 21 N.
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
Rifle
Creek
CUSTER COUNTY
1 Mile
5000 Feet
Scale 1:20000


54
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 47)
R. 22 W.
(Joins sheet 53)
(Joins sheet 55)
T. 21 N.
MIDDLE
LOUP
RIVER
Rifle
Creek
CUSTER
COUNTY
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35


55
N
(Joins sheet 48)
(Joins sheet 54)
(Joins sheet 56)
R. 22 W. R. 21 W.
T. 21 N.
2 050 000 FEET
2 065 000 FEET
150 000 FEET
MIDDLE
Creek
Rifle
LOUP
RIVER
Milburn
Diversion
Dam
MILBURN
SARGENT
CANAL
CUSTER COUNTY
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
1 Mile
5 000 Feet
Scale 1:20 000


56
N
(Joins sheet 49)
R. 21 W.
(Joins sheet 55)
T. 21 N.
LOUP COUNTY
CUSTER COUNTY
1 Mile
5000 Feet
Scale 1:20000
22
23
24
25
26
27
34
35
36
VaE
VaF
VaD
VeD
HfB
GfC
GhG
HeC